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"NEXT time give me stainless trim!" You hear it every week in almost every backyard or garage. For rusty automobile trim is now as old-fashioned as solid tires, or two-wheel brakes. Auto owners have already yielded too much of their precious spare time to the energetic job of getting rid of rust.

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Authority for this is based on surveys made at recent auto shows. 80 per cent of all people interviewed stated specifically that they would prefer stainless steel trim over all other types. 70 per cent said that they usually polish their own cars. Trim your cars with stainless. You'll find it means extra sales.

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UNITED STATES STEEL

IN THIS ISSUE . . . .

AUTOMOTIVE INDUSTRIES

Reg. U. S. Pat. Off.
Volume 80 June 15, 1939 Number 20

IN this issue the engineering drawing series catches up with the Kermath-Upton combination reverse and reduction gear for marine use. (Pages 709, 710.) For the next several issues the keynote of the series will be variety. Prints now in hand, from which tracings are being prepared for publishing include the Talbot-Darracq engine, the Holley aircraft carburetor, Warner Gear overdrives, the Perkins oil engine, and the Scannell oil engine.

INCIDENTALLY, nearly every drawing which appears in the series is retraced to meet the requirements of publication. Many a clean and crisp blueprint or tracing would be a jumbled mess if it were reduced to *A.I.* page size without special treatment. We have had to develop standards for thickness of line and cross hatching which would insure clear reproduction. We use lettering guides rather than freehand lettering, so that uniformity of lettering will be preserved as between the products of several draftsmen.

FOR the week following Oct. 3, it will be very difficult to get a hotel room in Cleveland. This is another way of saying that the Machine Tool Show will take over the town and the Auditorium. On behalf of AUTOMOTIVE INDUSTRIES, the largest space we have ever occupied at the show will be given over to visualizing the automotive and machine tool progress of the past four decades. On Oct. 1, immediately preceding the Machine Tool Show, there will be published an issue of AUTOMOTIVE INDUSTRIES dedicated to the same purpose.

IF you're one of those who bewail the fact that AUTOMOTIVE INDUSTRIES no longer publishes a semi-annual index, we'd like to call your attention to the fact that the magazine is indexed—thoroughly and professionally—by the *Industrial Arts Index* of the H. W. Wilson Co. Nearly every public library in the country and most of the special libraries subscribe to the *Industrial Arts Index*, and everything of importance in AUTOMOTIVE INDUSTRIES is listed therein. The most interesting thing to us about this fact is that *A.I.* is one of a relatively small number of publications which had to be included in the service because users demanded it.

GENERAL

Page

Industrial Statesmanship **693**

On the sixth of this month, Alfred P. Sloan, Jr., chairman of General Motors, was selected as the outstanding industrial executive to deliver the annual Alexander Van Rensselaer address at the Drexel Institute of Technology in Philadelphia. Mr. Sloan spoke forcefully from notes. The article which apears on p. 693 is our digest of the stenotype report of the address, and appears exclusively in AUTOMOTIVE INDUSTRIES.

MATERIALS

Synthetic Rubber-Like Materials **696**

It has been a long time since anyone attempted a comprehensive survey of the uses of synthetic rubber-like materials in motor vehicles and aircraft. We'll wager it contains a lot of "things you never knew 'til now."

Deephard Process **704**

A new technique to increase the depth of surface-hardening has been developed. It is one of those things constantly being introduced to the industry that one must know about to be well informed.

NEW DEVELOPMENTS

Men and Machines **706**

Manufacturers of machine tools have brought out enough new developments recently so that a perusal of this article is imperative.

BRAKES

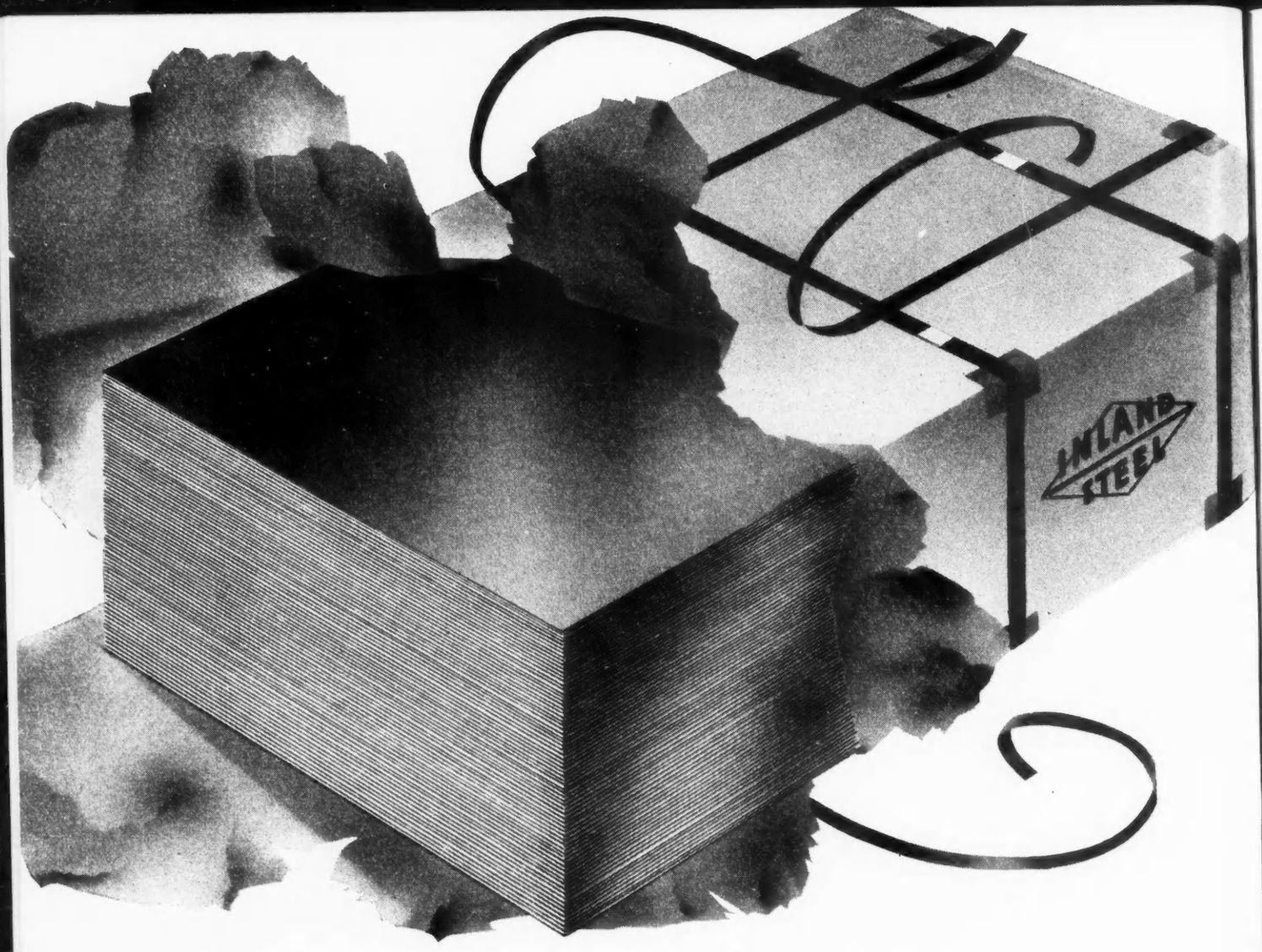
Girling Brake **711**

From our London correspondent comes a description of the new Girling Brake a development in this type of equipment that is distinctive in several of its features.

News of the Industry **723**

Business in Brief **695** **Just Among Ourselves** **703**

Engineering Drawings **709**



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AUTOMOTIVE INDUSTRIES

Published on the
1st and 15th of the Month

Vol. 80, No. 20
June 15, 1939

Industrial Statesmanship

must accelerate progress

By ALFRED P. SLOAN, JR.*

THE responsibility of industrial leadership, as things stand today, involves us in something beyond the limits of producing goods and services.

We know that our economy is becoming more and more involved. We know that our frontiers are now within the economy rather than without. We know that each component part of the economy, each unit within the economy, must be better correlated with the other parts. There is nothing new in this. It has been developing over a period of time, and as time passes, our industrial machinery becomes much more complicated. Therefore, it seems to me that industry and industrial leadership must look to the future, beyond the limitations of its individual horizons. It seems to me that we have got to pass from industrial leadership to industrial statesmanship, and industrial statesmenship is now required to protect the franchise of a free economy based upon individual initiative.

Industrial statesmanship must move toward accelerating progress, not only within itself, but economically, socially and educationally as affecting the whole structure in a more coordinated way.

This might be expressed in a single word as essential progress. Now according to my beliefs, the possibilities of progress are unlimited but the amount of progress is a state of mind.

THERE is a most wonderful opportunity before American industry to rebuild America with the instruments of productivity available through our technology of today.

The possibility of progress for industry, it seems to me, might be divided into three responsibilities: economic, social and educational. Economic responsibility means tuning the operations of industry in accord with the economy as a whole. For instance, there is the question of an economic wage. I mean by an economic wage, an hourly rate that results in the greatest productivity. Responsibility of industry on the economic side also involves the capitalization of technological improvement to produce better goods at lower prices. Also, we must give consideration to promoting new articles to manufacture, and, hence, developing job opportunities. All those things lead to a higher standard of living.

On the social side, I think we must give consideration to the decentralization of industry. I believe that organizations like our own should, and, as a matter of fact, we are trying whenever opportunity presents itself, to place our plants in smaller communities, so we will get a better balance between agriculture and industry. We will divide the load of industry, and when bad times come, and times cannot always be good, it will be easier to take care of the unemployed. They will be closer to agriculture, and they will have not only a higher standard of living and the cost of living will be less, but a better living also.

There is one thing that involves industry's responsibility which is very important, and this perhaps applies to big business more than it does to small business. Industry should be most careful not to use its great economic power unjustly. I believe that the criticisms of industry—I am speaking now of the big units of industry—are not so much as to the efficiency, the effectiveness or the contribution to the economy and the welfare of the community, but due to the fact that in too many instances industry uses its economic power unjustly.

The next point in industry's broadened responsibility that I see is the question of education. I think that is tremendously important. I believe that industrial leadership in the discharge of its broad applications for the development of industrial statesmanship has got to take the responsibility for telling the accom-

* Condensed from an address delivered by Mr. Sloan at the Drexel Institute of Technology, Philadelphia, on June 6.

GENERAL

plishments of industry to the people at large; and also to tell frankly and without reservations what must be done to promote still greater accomplishments of industry. This gets quite important on the economic side, and although I recognize that there are many problems in economics which are not thoroughly understood, and on which there is not a great deal of agreement, at the same time on certain things there is a complete agreement.

The question of telling the people what industry must do is of much consequence, because I believe, unless something is done, more than has been done in the past few years, our democracy is at stake. With our highly involved economic machine we must have a better understanding of its principles on the part of the people at large because their individual welfare is at stake.

As long as we are a democracy and the people exercise the privilege of determining what the policies are, they must have necessarily an educational background to make that possible.

Now, how are these responsibilities to be discharged? In the first place, everybody must do his part. Using General Motors as a case study, I would like to tell you what we are trying to do in that particular field. In the first place, I spend a good deal of my time in writing messages to our stockholders. Some of you ladies and gentlemen are perhaps stockholders and you have evidence of that. I try to tell not only the truth about General Motors Corporation, its position and a general statement of its affairs which stockholders are entitled to know, but I also try to supplement that with information as I see it regarding the general trend of the economic affairs as affecting the progress of General Motors as an institution. In addition to that, our various executives are required to appear before different organizations from time to time, as circumstances may justify, to tell the story of industry as they see it.

Again, we publish for the education of our workers a magazine which we call "General Motors Folks," which is really a picture magazine, somewhat like the publication "Life," but we insert in our magazine a lesson on business. For instance, the issue of a month or so ago took the annual report of General Motors, which is a highly involved, academic, financial type of thing, and we interpreted it in forms of pictures and figures and illustrations in such a way that most anybody could understand it, and that was distributed to our workers.

American workers are eminently fair—they want to do the right thing, and they reason. But they don't have a chance to understand what is going on—they don't know what it is all about; and if any of you have ever had contact with the type of literature that is put into the hands of the American workers by the Communists and all these other organizations, you would be surprised that the workers have the understanding and are as honest in their actions as they are. There is a tremendous job ahead in educating the American workers in sound and desirable principles of industry upon which their jobs depend. It cannot be done by one organization, it has got to be done by everybody doing their part; and it is a highly essential thing for all of us to do.

Today, according to my belief, the research end of industry is far ahead of the other functional activities, and we must inject the same scientific approach to our other functional activities like distribution, labor relations, and all the other things that go to make up industry's problems, and there is just as much room for research in those functional activities as there is in the ordinary conception of that term. And these groups in General Motors, I am talking about, are applying the scientific approach commonly ascribed to research, as such, into the other functional activities. It is perfectly remarkable the progress that we made when we got the technician and the practical men together to consider what we can do to inject a better technique and real progress into our operations, aside from dealing with the daily problems of administration.

A few weeks ago, I had an occasion to make a few remarks at the opening of the General Motors Building in New York, and I made the observation that it happened to be just five years ago that I had had a similar duty to perform at that time at the Century of Progress Exposition at Chicago; and I made

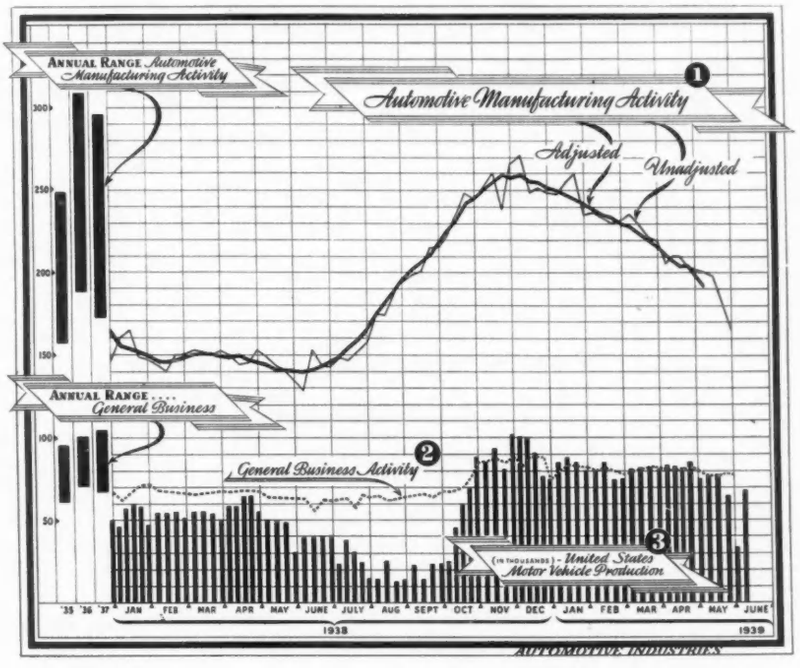
(*Turn to page* 739)

The Brass-Hat Rack

Our competitor's advertising sounds so good it almost tempts me!

BUSINESS IN BRIEF

Our own view of automotive production and sales; authoritative interpretation of general conditions



Weekly indexes of automotive and general business charted

June Production is Exceeding Forecast

PRODUCTION[3] of cars and trucks for the first full week in June was approximately 80,000 which, added to production for the preceding partial week, brought the count through June 10 to slightly more than 90,000. With Chrysler plants expected to return to previous schedules as a result of settlement of the Briggs strike, production for the second full week in June will approximate 75,000 cars and trucks. While it was difficult to determine whether this anticipated rate for the industry as a whole would remain in effect for the balance of the month, continuance of retail sales strength indicated by May sales figures could hold the figure at that level which would mean that the month would account for fairly close to 300,000 cars and trucks.

Early June production rates were higher than originally anticipated and would have been even higher if Chrysler and Lincoln assemblies had not been halted by the Briggs strike. Sales reports for May, issued by a number of producers, showed May sales were higher than April which is an important development including as it did such major producers as Chevrolet and Ford. While final figures were not yet in, R. L. Polk & Co. estimated that May domestic passenger car sales would total 285,000 as compared with 268,500 for April.

According to the official estimate of production released by the Automobile Manufacturers Association, April car and truck output totaled 312,160 units.

AUTOMOTIVE MANUFACTURING ACTIVITY for the week ended June 3, as indicated by the unadjusted index curve[1] on the accompanying chart, skidded down to 166 on a straight-line downward path established by the figures 179 for the preceding week and 198 for the week ended May 20.

The downward trend of the adjusted curve[1] continued through the index levels of 204 for the week ended April 29, 199 for the week ended May 6, and 192 for the week ended May 13.

GENERAL BUSINESS ACTIVITY[4] has picked up appreciably in recent weeks. The index of *The Journal of Commerce* for the week ended May 27 advanced seven fractional points to 82.5 as compared with 81.8 for the preceding week.

Further expansion of retail trade during the week ended May 27 reflected prevailing weather conditions, with gains over the corresponding 1938 levels ranging from 6 to 12 per cent.

Railway freight loading in the week ended May 27 totaled 627,674 cars, the largest number in any week so far this year. Cars loaded in the week ended May 20 totaled 615,966.

The output of electricity by the power and light industry for the week ended May 27 was 11.7 per cent above the corresponding 1938 production, comparing with a similar excess of 10.3 per cent in the preceding week.

Professor Fisher's index of wholesale commodity prices dropped for the week under discussion to 79.2, the lowest level so far this year, as against 79.7 for the preceding week.

[1] 1923 average = 100; [2] Prepared by Administrative and Research Corp., New York. 1926 = 100; [3] Estimated by J. A. Laansma, Detroit News Editor, AUTOMOTIVE INDUSTRIES. [4] Summarized for AUTOMOTIVE INDUSTRIES by the Guaranty Trust Co. of New York.

BUSINESS ACTIVITY

Automotive MATERIALS 28

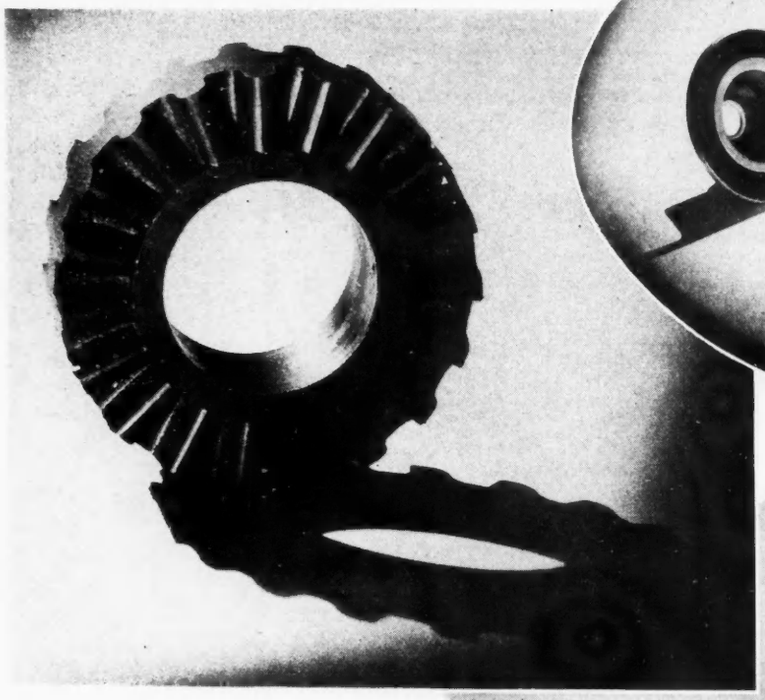
Synthetic

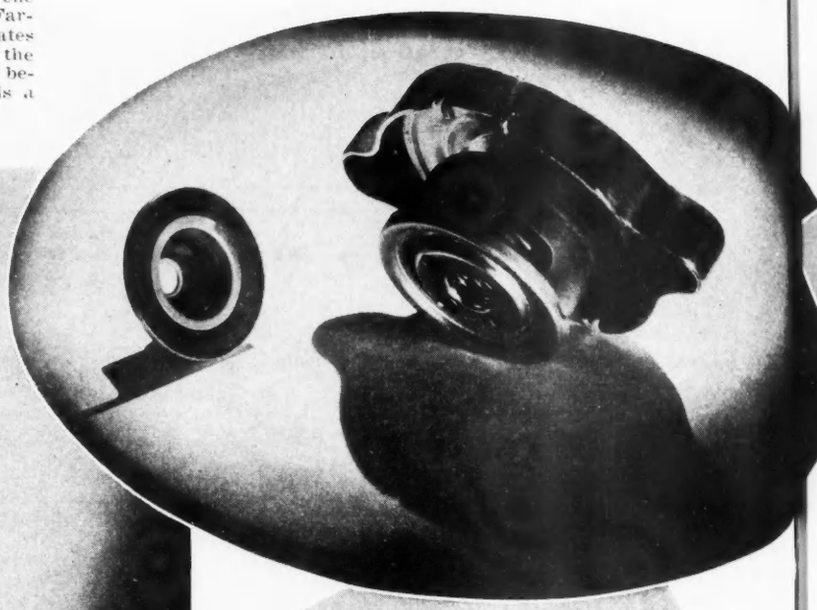
By H. E. BLANK, Jr.

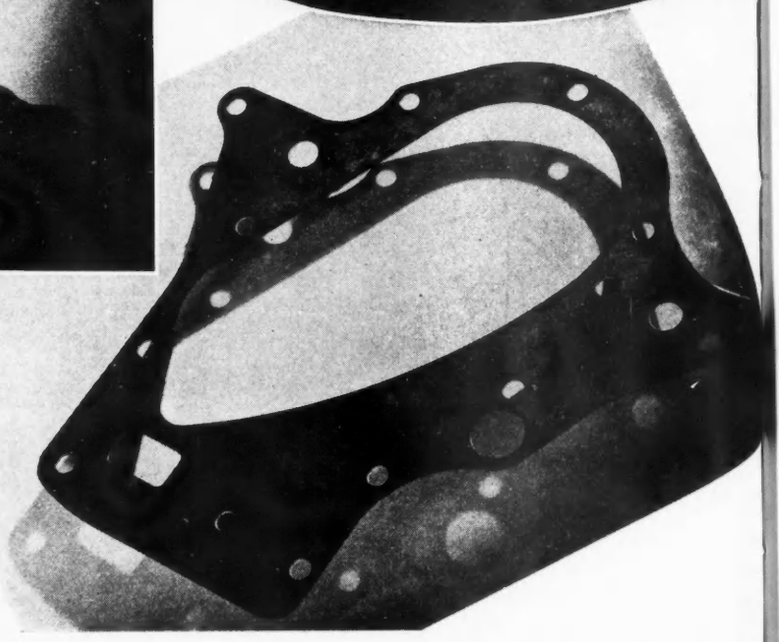
THE industrial significance of synthetic substances with rubber-like properties dates back only to the beginning of the present decade when the commercial development of these materials was for the first time undertaken on a large scale. While many such synthetics have been evolved by the short but intensive intervening period of research, the principal products now sold in the United States for automotive and aircraft applications are Koroseal, Neoprene, Perbunan, "Resistoflex" PVA, and Thiokol.*

According to E. R. Bridgwater of E. I. du Pont de Nemours & Co., "There is no commercial product that can be called synthetic rubber because, if the accepted usage of the past is followed, synthetic rubber would be a product substantially identical with natural rubber in chemical and physical properties." Synthetic rubber-like materials are defined by Mr. Bridgwater as ". . . . substances that resemble rubber in the single property of extensibility or deformability under moderate loads, coupled with a tendency to recover their original form when the load is removed, although not necessarily to a degree comparable to the recovery exhibited by natural rubber."

*Koroseal is a product of the B. F. Goodrich Co.; Neoprene of E. I. du Pont de Nemours & Co.; Perbunan of I. G. Farbenindustrie A-G and sold exclusively in the United States through Advance Solvents & Chemical Corp.; "Resistoflex" of the Resistoflex Corp.; and Thiokol of Thiokol Corp., the latter being manufactured by the Dow Chemical Co. "Thiokol" is a Registered Trade Mark, U. S. Patent Office.







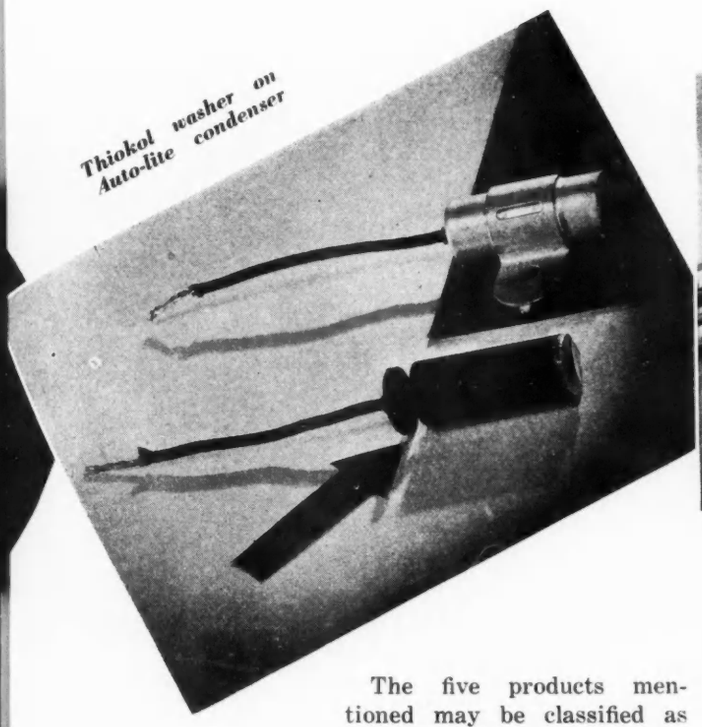
(Above) Molded Neoprene gear for aircraft magneto

(Oval) AC Spark Plug pressure radiator cap using neoprene gaskets

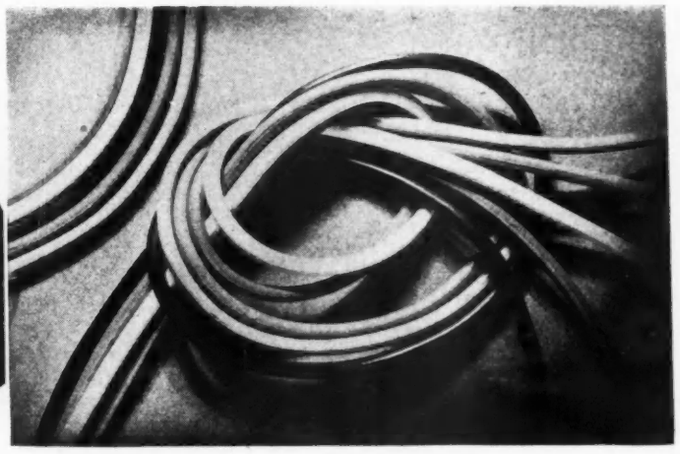
(Right) Gasket of special carton paper impregnated with liquid Thiokol cement. Used on Chrysler cars.

Rubber-Like Materials

are constantly being introduced to new functions in the automotive field



Thiokol washer on Auto-lite condenser



Apparatus and machinery wire insulated with Koroseal

The five products mentioned may be classified as materials similar to rubber in chemical composition and those that are not. In the first category are Neoprene and Perbunan, while the other three are of the latter type. Perbunan is polymerized butadiene, with or without the addition of modifying agents. Neoprene is polymerized chloroprene. Both Perbunan and Neoprene are similar to rubber in appearance and physical properties. While they may be vulcanized, they cannot be remolded into other shapes after vulcanization.

Of those synthetics named in the second group the basic chemical constituent for Koroseal is plasticized polyvinyl chloride resin; for "Resistoflex" PVA, plasticized polyvinyl alcohol; and for Thiokol, alkyline sulfides. These products, with the exception of "Resistoflex," when vulcanized remain thermoplastic, and may be remolded into other forms. "Resistoflex" PVA compound is not truly thermoplastic. It does not vulcanize, and after forming can only be remolded at considerably higher temperatures than those originally used.

Thiokol appears to have been the first commercial synthetic rubber-like material produced in the United States. The story is told that it was discovered quite by accident by Dr. J. C. Patrick who, in seeking to evolve a new automobile anti-freeze, happened to bring together ethylene dichloride and sodium polysulfide. The gummy offspring of this chemical union was recognized as quite similar to natural rubber.

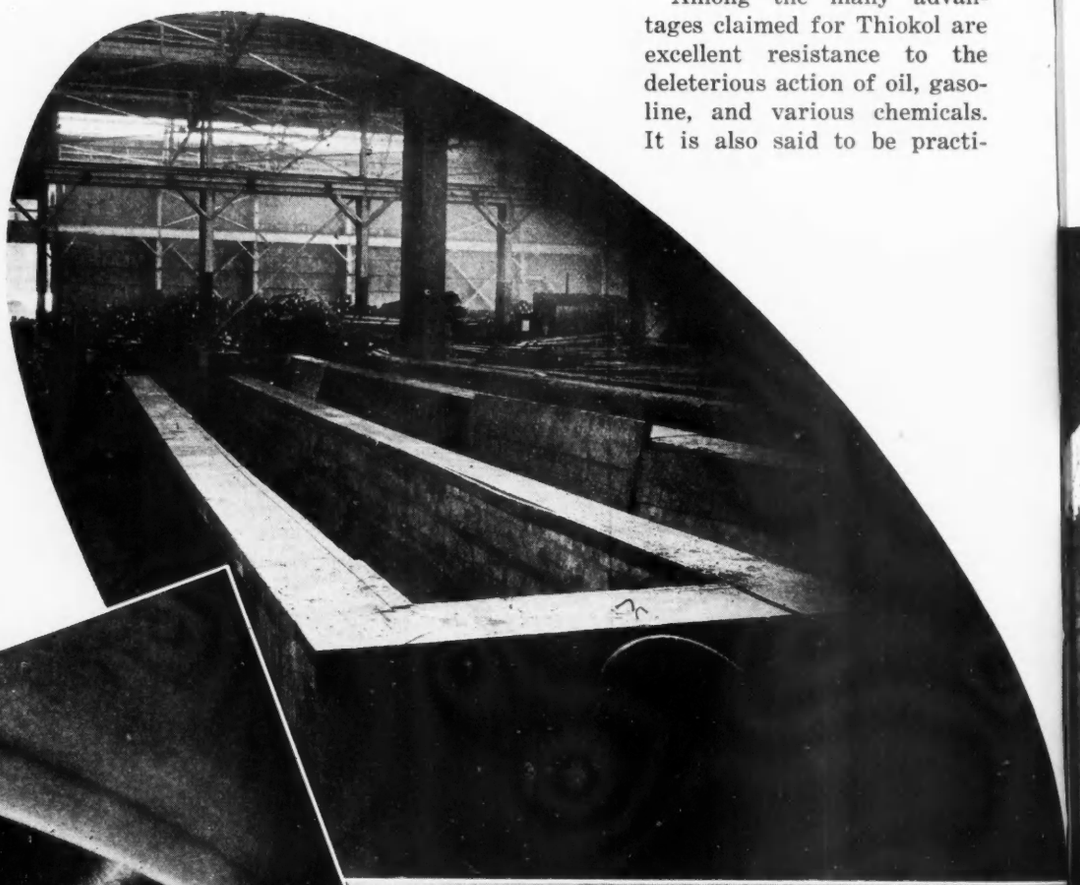
Previous to Dr. Patrick's experiments, others abroad had worked purposefully toward the production of synthetic rubber-like materials with some degree of success. To Bouchardat, a Frenchman, is credited the discovery of isoprene, basic hydrocarbon of rubber. By the destructive distillation of natural rubber, Bouchardat was able to produce isoprene which he polymerized. Polymerization converted the isoprene into a rubber-like material, and Bouchardat proved that polymerization of the hydrocarbon was fundamental to the manufacture of synthetic rubber-like materials. Polymerization, in simple terms, is a chemical action in which molecules of the original material are enlarged with the result that the mass of the

final product is heavier and sometimes quite viscous and gummy.

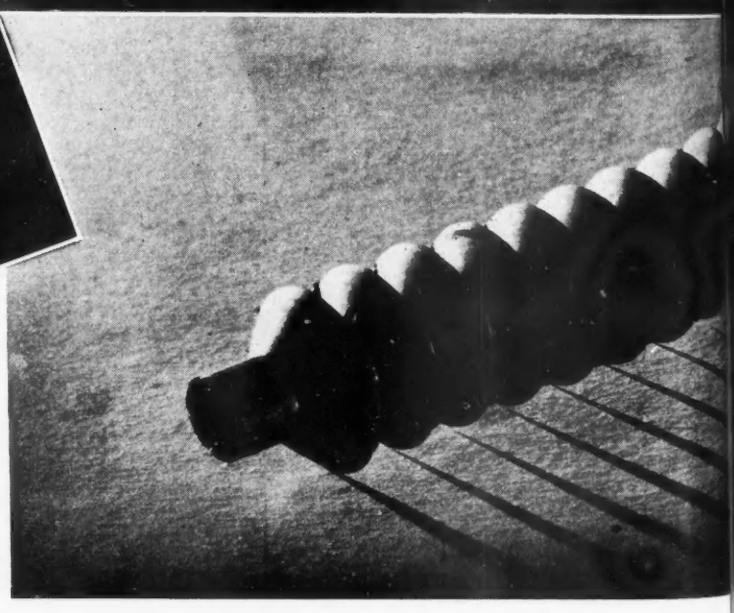
During the World War when the Germans were sorely pressed by lack of raw materials, including rubber, they extended Bouchardat's work and were able to produce a small quantity of synthetic rubber-like material. While this product was not very satisfactory, post-war developments of the German chemists brought forth a definitely improved product. Other countries moved forward with intensive research programs and shortly thereafter the quality of the synthetic material was further improved by the almost simultaneous discovery in the United States, England and Germany of a catalyst in the form of metallic sodium.

Thiokol is produced from three basic raw materials: sodium chloride, sulfur, and natural gas. The process entails the mixture of ethylene—obtained from natural gas—with chlorine—obtained from salt—to produce the liquid ethylene dichloride. Another liquid, sodium polysulfide, is made from caustic soda—also obtained from salt—and sulfur. By mixing the chlorinated hydrocarbon and the sodium polysulfide in the presence of a catalyst, a latex results which is washed with water to clean away any excess polysulfide and sodium chloride. When the latex is treated with acid, it coagulates to a rubber-like substance. This is then put through a drying process. The reaction is not confined to ethylene dichloride. By using other chlorinated hydrocarbons a whole series of rubber-like materials can be made.

Among the many advantages claimed for Thiokol are excellent resistance to the deleterious action of oil, gasoline, and various chemicals. It is also said to be practi-



(Right) Koroseal-lined steel tank, sheathed with Toronto acid brick and basolit cement. Dimensions approximately 40 ft. by 4 ft. 6 in. Used for treating stainless steel tubes and bars.



(Above) Thiokol gasoline tank filler neck hose

cally impervious to the oxidizing effects of air and ozone. These properties alone make the material desirable for a large number of automotive and aircraft applications. One of the most recent adaptations of Thiokol to automotive use is the development of gaskets made by impregnating special carton paper with liquid Thiokol cement. This gasket was designed by the Chrysler laboratories in cooperation with the Felt Products Mfg. Co. and found use as an oil seal in about 12 different places on Chrysler cars. The gasket is not only oil proof but tends to "flow" under pressure, thus providing an ideal seal. The gasket illustrated on page 696 is one of this type and is used to provide an oil seal between the chain plate cover and the housing protecting the camshaft drive on Chrysler cars. In actual size the gasket measures 12 in. by 9¾ in.

Large quantities of Thiokol are used for airport service hose, airplane fuel and oil-line hose. In the form of a liquid sealing compound it is used successfully for stopping leaks in aircraft fuel tanks. For use in engines and oil lines, Thiokol tubing has been developed that will perform satisfactorily at temperatures not in excess of 225 deg. Fahr.

Electrical properties of Thiokol are used to advantage in Auto-lite condensers. Two washers made of this material provide protection against jumping sparks, heat, and oil. The washers also serve the purpose of insulating the condenser from the metal jacket, which appears in the illustration on page 697, below the assembled unit.

A Thiokol hose line is used on Bendix vacuum power brakes. The manufacturer's specifications for hose used in this instance state, "After a sample of this hose has been filled with gasoline and oil for periods of 48 hours each, it shall not collapse or leak under a vacuum of 29 in. of mercury. Neither shall the outside or inside diameters show any appreciable change in dimension or show signs of disintegration."

High tension ignition cable for automobile engines is made with Thiokol insulation without braid or other outer covering. The synthetic provides the important properties of toughness, elasticity, and high dielectric characteristics. Other advantages in this application are good corona, oil and heat resistance.

A partial list of Thiokol applications recently published in *Thiokol Facts* includes packings, hose liners, flexible oilproof nozzles, protective garments, industrial equipment, tank sealers, gaskets, cup washers, insulating cables, balloon cloth, pumping units, valve set disks, extension cords, pickling tank cements, gas tank connections, booster brake hose, and flat and V-belts.

The most recently-developed synthetic of the group under discussion is "Resistoflex" PVA, a flexible synthetic resin which is basically polyvinyl alcohol. Manufacturers of this material hope to extend its use throughout the automotive and aircraft fields because of its imperviousness to the action of oils, gasolines, kerosene, greases, and organic solvents, such as chlorinated hydrocarbons, aliphatic and aromatic ketones, etc.

When tested for permeability to liquids and gases, "Resistoflex" PVA reportedly shows a permeability one-twentieth that of rubber. Other desirable properties of this material include pronounced elasticity, resilience and flexibility. Repeated flexing apparently does not injure PVA and, in addition, the material withstands torsion and, even though it may be tied into knots without being damaged, it will not kink in service. Inasmuch as the material has a short bending radius it is used successfully in feedline connections. The manufacturer also points out that its flexibility and resistance to flexing and twisting make it a very efficient vibration absorber. "Resistoflex" PVA hose has eliminated difficulties in handling Diesel fuel, refrigerants, lubricating oils, and cleaning fluids inasmuch as it is unaffected by these fluids, does not slough off or deteriorate.

High tensile strength and resistance to impact and pressure are given as other desirable properties of

(Above) Raw Thiokol ready for shipment to the manufacturer

(Left) Neoprene handbrake cable bellows for Chevrolet. Seals against dust, oil and water

PVA. Being tough and strong the material can be used for vacuum tubing as well as for high pressure tubing. Further, PVA withstands fatigue or deterioration in aging. While it will harden somewhat in long service, there is no evident checking or cracking.

This material was introduced in the United States about three years ago by the Resistoflex Corp. PVA compounds are now available in the form of hose and sheet material and are soon to be made available in all the manufactured forms of washers, gaskets, diaphragms, molded and dipped goods. The specific gravity of this material is approximately 1.26. When made into hose it is reinforced with textile fabric with a synthetic rubber or lacquer cover.

Applications of PVA tubing include use in gasoline, oil and grease lines; air and vacuum lines and breather tubing; oil filter and decarbonizing lines; clutch and brake lines; and for vibration absorber connectors. As in the case with several other synthetic rubber-like materials discussed in this article, PVA materials may be used in machine tools, fuel pumps, paint and varnish and lacquer sprayers, hydraulic benders and other hydraulically operated equipment.

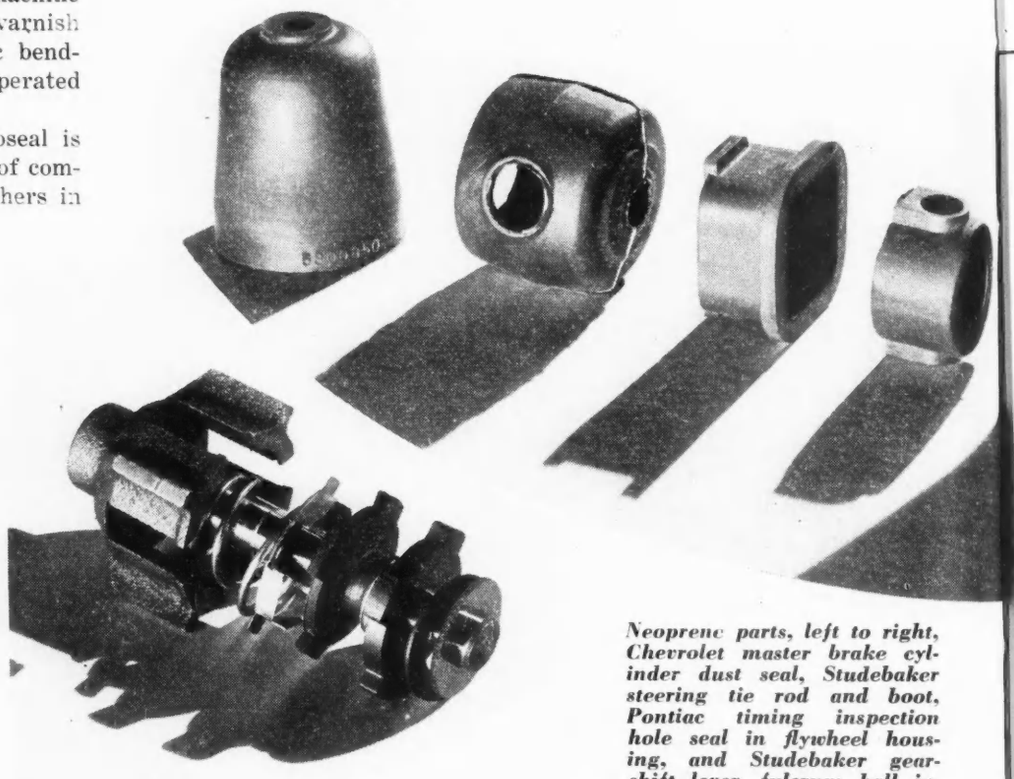
The synthetic known as Koroseal is manufactured in a wide variety of compounds, some quite hard and others in liquid form. Solid compounds are named Koroseal, liquids are called Korolac, and a jelly-like form is known as Korogel. B. F. Goodrich Co., the manufacturer, supplies this material only in the form of finished products. The properties claimed for it include resistance to prolonged flexing, resistance to the deleterious effects of sunlight, absence of swelling or disintegration in the presence of certain oils and solvents, resistance to strong corrosives, to water and to oxidation.

Here are some other properties of the material: Shore Soft Rubber Durometer tests indicate hardness ranging from 100 points for the hardest compound down to 15-20 points for the softest. The degrees of heat will affect the hardness of Koroseal inasmuch as the material is a thermoplastic. Tensile strength of the harder compounds will exceed 7500 lb. per sq. in. Maximum elongation is approximately 300 per cent. Specific gravity ranges from 1.25 to 1.4. Color of the unpigmented compounds varies from dark brown to a light translucent amber. Other colors, of course, may be obtained by introducing the proper pigments. Compression set varies according to the nature of the compound with the minimum being one per cent measured 30 minutes after release from 400 lb. per sq. in. constant load at room temperature for 22 hours. The product is practically non-compressible in the sense that regardless of distortion it remains virtually constant in volume.

Abrasion resistance of Koroseal is claimed to be at least equal to rubber under service conditions where heat is not generated. Slight softening of the product will begin at 100 deg. Fahr., and it becomes quite soft at about 250 deg. Fahr. Manufacturers' specifications list the useful temperature range of Koroseal compounds as from 15 deg. below zero Fahr. upward and do not recommend use of the product in temperatures over 150 deg. Fahr.

This Goodrich synthetic is said to be resistant to the following corrosives: 1. sulfuric acid up to and including 66 deg. Be.; nitric acid in all concentrations; hydrochloric acid in all concentrations; all caustic solutions; chromic acid (chrome plating solutions); thirty per cent hydrogen peroxide concentrate; ten per cent sodium hypochlorite; saturated aqueous sulfurous acid; oleic and lauric acids; hydrofluoric acid; most of the well-known commercial heavy chemicals; mixtures of the above chemicals; and aqua regia after two months' test at room temperature showed no effect.

The manufacturer does not recommend Koroseal for applications where "service conditions require

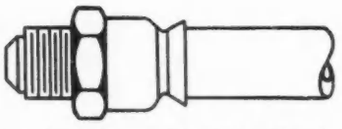


Neoprene parts, left to right, Chevrolet master brake cylinder dust seal, Studebaker steering tie rod and boot, Pontiac timing inspection hole seal in flywheel housing, and Studebaker gearshift lever fulcrum ball insulator

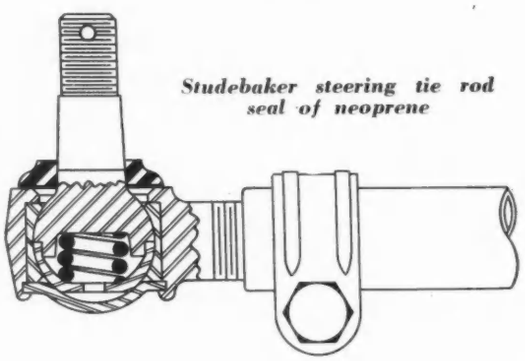
Exploded view of water pump assembly showing neoprene seal

complete and constant immersion" in organic compounds containing chlorine, organic compounds containing nitro groups, aliphatic or aromatic ketones, aromatic amino compounds and gasoline or other solvents.

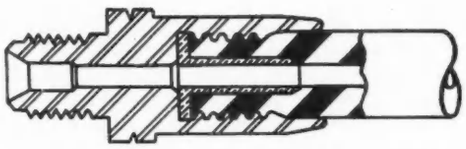
Neoprene is the relatively new term for "DuPrene," a synthetic rubber-like material developed about 14 years ago by the Organic Chemicals Department of the du Pont company. In the early stages of the development of this material, du Pont chemists chose acetylene as the most desirable raw stock because of its reactivity and availability in unlimited quantities. First research efforts in this direction bore little fruit, then Father J. A. Nieuwland of the University of Notre Dame discovered a catalyst consisting essentially of a saturated solution of cuprous chloride and ammonium chloride in water with which he was able to polymerize acetylene to divinylacetylene. By modifying the conditions under which acetylene was exposed to the Nieuwland catalyst, du Pont chemists produced monovinylacetylene. This hydrocarbon was treated with hydrogen chloride in the presence of a catalyst to form chloroprene. Polymerization of the chloroprene resulted in a synthetic rubber-like material of high quality.



Neoprene hose is used in this vibration absorbing connector on Studebaker cars for the oil pressure gage pipe



Studebaker steering tie rod seal of neoprene



Studebaker flexible brake fluid conduit hose made of neoprene

The character of the acetylene reactions in this process required the use of large-size equipment to produce even experimental quantities of the synthetic and in 1931 the company started construction of a large-scale pilot plant. During the ensuing three years about a half-million pounds of "DuPrene" were produced and supplied to rubber manufacturers for fabrication. As the valuable properties of the material became known to users, manufacturing facilities were continuously expanded. In 1936 the trade-name "DuPrene" was superseded by Neoprene, a generic term used not only to describe du Pont's chloroprene rubber but also to describe the various products made from it by the rubber manufacturers.

In the production of neoprene parts the material itself is first mixed with various ingredients to form what are known as unvulcanized compounds. Fabrication is done on the same equipment used to produce parts of rubber and the neoprene compositions are also heat treated or vulcanized.

With regard to the basic properties of neoprene, the manufacturer lists the specific gravity of the material itself as 1.25. However, the specific gravity ranges from 1.40 to 1.80 for the majority of compounds, according to the type and amount of included pigments. Some of the neoprene compounds have a specific gravity as high as 3.00. Tensile strength may range anywhere from 200 to 4000 lb. per sq. in. So far as resistance to abrasion is concerned, neoprene compounds are said to perform especially well under severe service conditions because of their high resistance to deteriorating influences. While neoprene compounds may be made into electrical insulators, they have been found to be inferior to similar rubber compounds with respect to power factor and volume resistivity. On the other hand, the electrical break down strength of neoprene is slightly better than that possessed by similar compounds of rubber, and a compound of high neoprene content will—in the dry state—withstand 860 volts per mil of thickness. The neoprene also has excellent corona resistance.

"Pure gum" or high content neoprene compounds have a thermal conductivity "K" of 1.45 B.t.u. per hr. per sq. ft. per in. thickness for a temperature difference of one degree fahrenheit. There are, of course, other physical properties which are a factor in certain applications, such as tear strength, diffusion of gases, hysteresis characteristics, vibration absorption, and permanent set. Gases will diffuse at a slower rate through neoprene than through rubber. When subjected to dynamic loading neoprene surpasses rubber in damping effect. Under constant load the neoprene will tend to drift or deform, although the deflection quickly attains a maximum and the amount of permanent distortion when the load is removed is quite low. While recovery is virtually as complete with rubber, it requires more time.

One of the chief assets of neoprene is its stability in the presence of potentially destructive factors such as oil, sunlight, heat, and numerous chemicals. While neoprene will swell somewhat in the presence of oil, as does rubber, it doesn't expand nearly as much and, in addition, possesses the desirable ability of retaining much of its strength, toughness and elasticity. Neoprene exposed to sunlight for a long period will change only to the extent that it tends to stiffen slightly. Special types of neoprene compounds are made to give the best results in resisting heat. When subjected to elevated temperatures (above 300° F) neoprene compounds tend to harden and will even-

tually fail by turning brittle. No resilience is lost in the elevated temperature. Oxidation, one of the most insidious of the deleterious influences on rubber, is not so much a bugaboo to neoprene.

Generally, neoprene compounds exhibit excellent resistance to various chemicals, but in many instances special compounds of neoprene are recommended. Most of the salts, for instance, have very little if any effect on neoprene. Du Pont chemists state that even at high temperatures sulfuric and hydrochloric acids up to 30 per cent concentration "cause no serious deterioration." Hydrofluoric acid will bring about slow deterioration, while alkalies apparently have little effect in ordinary concentrations. The manufacturers of neoprene do not recommend that it be used in the presence of concentrated nitric acid or chromic acid. Among the organic chemicals, the alcohols do not have much effect on neoprene or rubber. Aromatic hydrocarbons, however, such as benzene, toluene, and

(*Turn to page* 719, *please*)

Automotive MATERIALS NEW DEVELOPMENTS

G. E. Adds Glyptal Gray to Line of Welding Accessories

A recent addition to the line of welding accessories made by General Electric Co. is Glyptal 1294 Gray. It was developed to meet the need of fabricators for a material which, when applied to metal to be lap welded, would prevent corrosion at the point where the plates overlap. The material is a pigmented version of the previously announced Glyptal 1294 Clear and will, like the latter, prevent the adhesion of weld spatter when applied to parts before welding. In addition to preventing corrosion at the overlap, it is said to serve as an excellent base for paint.

Glyptal Gray can be sprayed or brushed and the work can be left exposed to the atmosphere until fabrication is complete with the assurance that edges of the parts will not need cleaning before the final welding operation.

"Triple Casting"—A Method of Producing Piston Rings

"Triple Casting," a proprietary method of producing piston rings has been developed by The Hastings Mfg. Co., Hastings, Mich., over a period of some years. Rings produced by this method have been used for four years in all "Steel-Vent" and other Hastings combinations.

Triple-casting is essentially a method of making individual castings of sufficient width to produce three rings which are split off the casting on special machines. It is claimed by the manufacturer that while this method yields all of the advantages of individually-cast rings, in the case of thin rings of the order of $\frac{1}{8}$ in. or less, it makes possible much lower pouring temperatures, thus assuring a structure containing the correct percentage of graphite as well as the proper graphitic formation.

Rings produced by the Triple-Casting method are

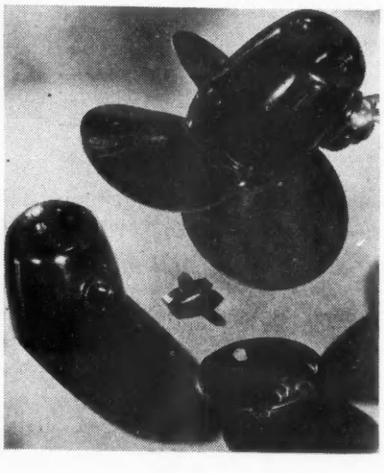
(*Turn to page* 738, *please*)

Baking Enamel Reproduces Colors of Many Metals

Baking enamel which reproduces the colors of many metals has been developed by Maas & Waldstein Co., Newark, N. J. With this new enamel, according to the manufacturer, any polished metal can be made to resemble brass, chemically treated aluminum and steel, and other colored metals.

The new product is called "Baking Platelustre" and is said to be very durable when baked. After baking it will resist the action of cleaning operations and also nickel, chromium and other plating baths so that, when applied sectionally, a wide variety of effects is made possible. Flat stock finished with this enamel can be formed after baking. Two-color finishes can be obtained by "relieving" operations.

"Baking Platelustre" can be applied to any kind of polished metal by spraying or roller coating.



For their latest model summer cooling or winter defrosting fan, Casco selected a molded Durez plastic housing in a brown mottle finish. Rubber blades are set in a metal stamped of the same mottle color. Durez molding compound is manufactured by General Plastics, Inc., North Tonawanda, N. Y., and the housing for the Casco fan was molded by the Waterbury Button Co.

AUTOMOTIVE INDUSTRIES

Just among Ourselves

THE roster of those companies in the automotive industries which have done outstanding jobs in the field of employe relations is lengthening. There is no standard formula which covers effective efforts in this direction, but there are certain canons which can be distilled out of observing what has been done.

As we see it, the foremost requirement is that the employe relations activity must be in the hands of a responsible executive who enjoys the complete confidence of management. There is little possibility of his winning the confidence of employes if it becomes apparent, sooner or later, that his knowledge of the plant and its policies is limited.

Second in importance to the question of the man is the question of time. Dramatic and forceful solutions to crises in employe relations have their place in the scheme. Failure to apply them when necessary would negate the effect of almost any program. But, basically, any employe relations program should be viewed as something which is a necessary and integral part of a management program—from here on.

Thirdly, no program of public relations worthy of the name can be founded on anything but a sound employe relations policy. The employes of a company are its most intimate public, the stockholders next, the citizens of the towns in which it manufactures and operates next. The present purchasers of its products, the potential purchasers, and the public at large, including its elected and appointed representatives, must be added to this list.

Begins At Home

But it cannot be emphasized too heartily that the public relations program begins with the employes of the company and their families.

Looking over the whole field of "Public Relations for Business," Milton Wright recommends study of the methods of General Motors, Chrysler and Caterpillar Tractor as outstanding in the automotive field. We have little fault to find with the choice. Each of these companies is both big business and little business according to where you bump into it. In Flint, Michigan, for example, General Motors is big business—it's the whole town. But in thousands of small communities where it is represented by a small plant, or a dealership, General Motors is little business. It is one of the virtues of the GM public relations program that this fact has been recognized, and the program has been adapted to local needs.

It is this fact also which makes the public and employe relations policies of the big corporation worthy of study by business of any size. But such study should be accompanied by references to case histories of scores of smaller companies which have done effective work; to companies whose varied individual problems may furnish a closer parallel to one's individual problems, as seen after careful analysis.

Rich in Telling Experiences

The automotive field is becoming increasingly rich in instructive case histories. In the transportation division there is the Fifth Avenue Coach Company. In the parts field one recalls the Clark Equipment Co., Waukesha Motors, Borg-Warner, to mention a few. Studebaker and Packard must be included in any list of passenger car companies which have done an effective job of employe relations. There are many other companies which might be included in such a list.

A year or so ago, as we see it, discussion of employe relations could not be divorced from a discussion of the Wagner Act, and other administration moves. As of today, it is becoming apparent to management that the question of employe relations will have to be considered on a realistic basis of which the Wagner Act, and the current struggles between the A. F. of L. and the C.I.O. are only transitory phenomena.

No matter which way the 1940 elections swing, no matter what modifications may be made to the legislative and judicial approach to labor problems, the question of sound relations with the employes of a particular plant will be the number one problem of management.

The fact that more and more executives in the automotive industries are aware of this, is one of the healthiest signs in the future of motor-vehicle manufacturing.

Even So, Across the Sea

Our remarks on the place of songs in the early history of automobile advertising drew from John Younger, professor of industrial engineering at the Ohio State University, a letter which pointed out that such songs were not limited to the American portion of the industry. Professor Younger, who collects such songs as a hobby, quotes several which were published in England when the automobile and the airplane were young. The music hall and the topical song still flourish in England, God bless 'em, and to this observer, one of the outstanding benefits of short-wave radio broadcasting is the fact that they can be brought into the American living room.—H. H.

DEEPHARD PROCESS . .

A NEW process of surface-hardening steel, known as the "Five-Point Deephard Steel Process," has been developed by Foote Bros. Gear and Machine Corporation, Chicago. This firm manufactures gears of all kinds, some of them intended for services in which they are exposed to severe shock load, in addition to the abrasive action on the tooth surfaces. With inferior grades of steel such service conditions are apt to result in spalling, fatigue, and impact failure. These conditions call for hardness depths of from 0.187 to 0.250 in., and for the maximum surface hardness compatible with a spall-resisting grain structure, as well as for a gradual transition from the hard surface layer to the core underneath. We understand that it was with the object of developing properties enabling the steel to withstand such conditions that the new process was developed. The term, "Five-Point Deephard Steel," which has been trade-marked by the corporation, applies to steel of any composition that responds to a "carbonizing" treatment and that has been treated by the firm's process. For the following information regarding results obtained from the treatment when applied to various grades of carburizing steel we are indebted to H. G. Hobbs, sales manager of the Steel Specialties Division of Foote Bros. Gear and Machine Corporation.

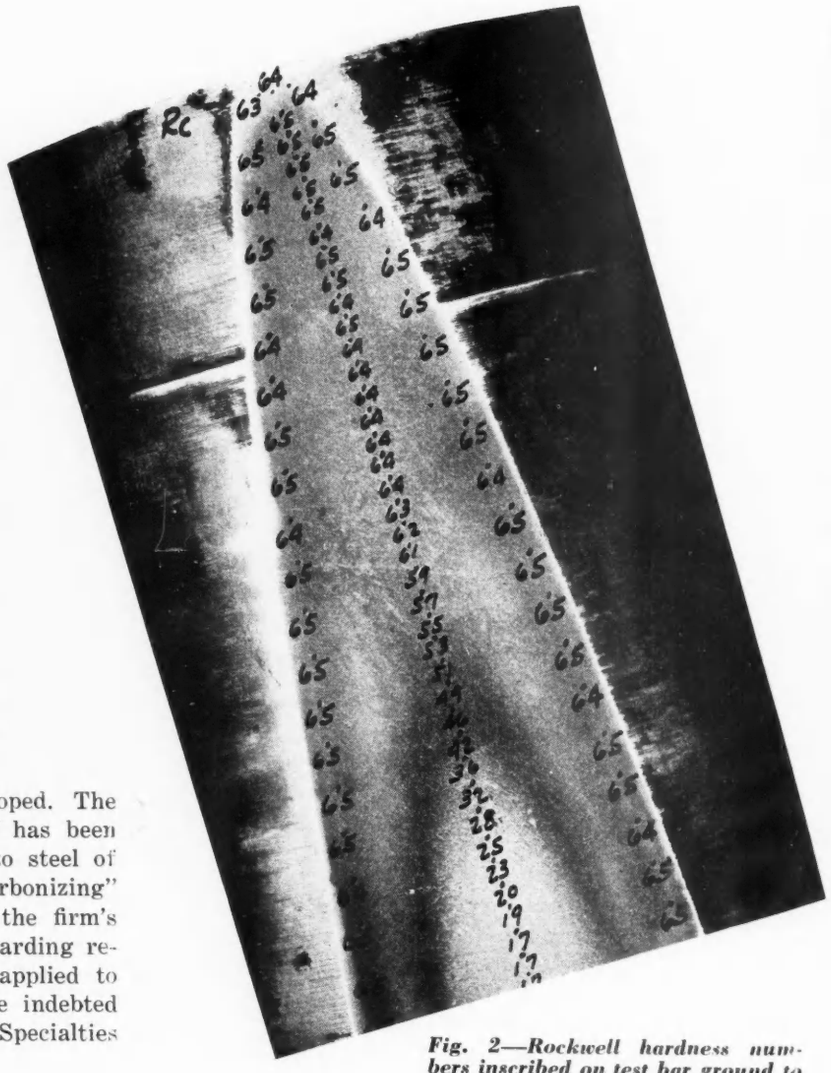


Fig. 2—Rockwell hardness numbers inscribed on test bar ground to a flat taper on one side.

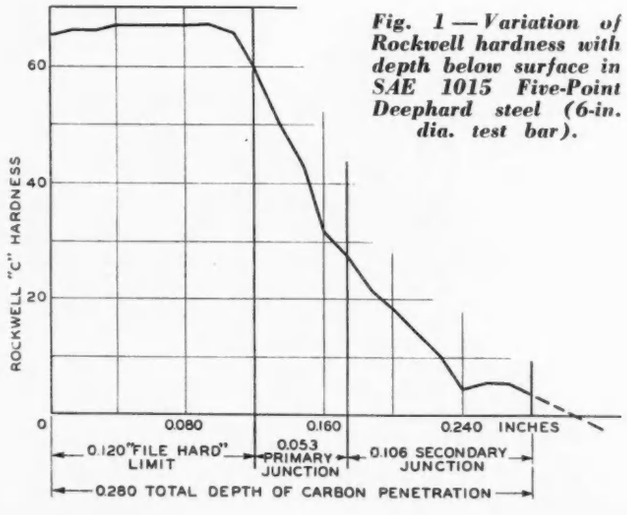


Fig. 1—Variation of Rockwell hardness with depth below surface in SAE 1015 Five-Point Deephard steel (6-in. dia. test bar).

With the Five-Point Deephard process it has been possible to obtain a surface hardness of from 60 to 68 Rockwell C, depending on the analysis of the steel. Fig. 1 herewith shows the degree of uniformity obtained in wearing-surface hardness with SAE 1015 Five-Point Deephard steel, the case being 3/16 in. deep.

To get a line on the degree of uniformity of hardness obtainable with this process, hardened surfaces measuring 6 by 9 in. were completely explored with a Rockwell hardness-testing machine, readings being taken at ½-in. intervals in both directions. Hardness variations in any one piece were limited to maximum values of two or three points, while the majority of

designed to obviate flaking and spalling of gears . . . . . .

the tests showed the hardness to be uniform over the entire surface. (See Figs. 1 and 2.)

The Five-Point Deephard steel process gives a high degree of control over the carbon content of the hardened surface, which may be held to 1.15 per cent over the whole depth, but for most applications limits of 0.93 and 1.10 per cent are set. The process, moreover, permits of developing consistently a grain structure similar to that of tool steel. As shown in the microphotographs of Fig. 3, the carbon is well diffused, there being no network of free cementite. From experience accumulated in the course of a year it is concluded that a grain structure showing between 5 and 15 per cent cementite embedded in martensite can be produced consistently, a structure which is held to be ideal from the standpoint of wear resistance.

Depths of wearing-surface hardness up to 0.320 in. can be obtained in a shorter time than required with the conventional carburizing process. Light depths of hardness can be obtained in a very short time, and the company is regularly turning out work with a hardness depth of only 0.020 in.

A rapid drop in the carbon content from the hardness zone to the core is said to be a major cause of shock failure or spalling of case-hardened parts. The gradual decrease in the hardness of Five-Point Deephard steel, indicative of a gradual decrease in the carbon content, as shown in Fig. 1, assures diffusion

(*Turn to page* 718, *please*)

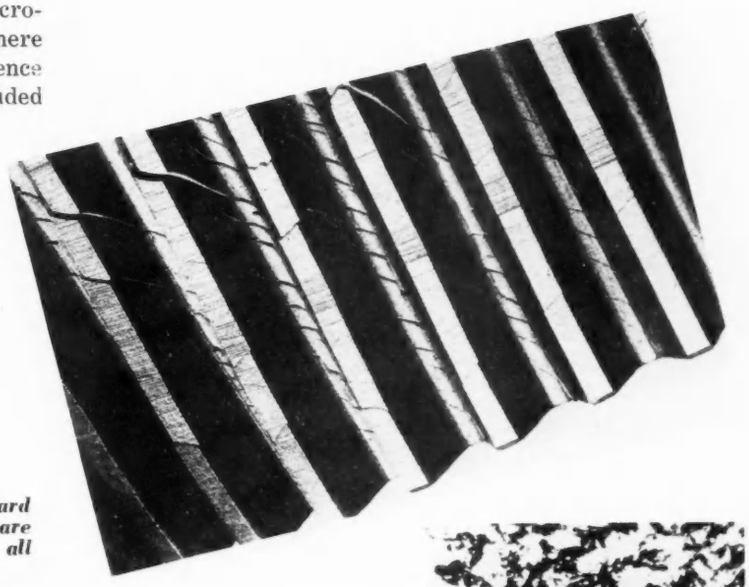


Fig. 4—Gear of Five-Point Deephard steel tested to destruction. There are no evidences of flaking or spalling, all fractures going into the core.

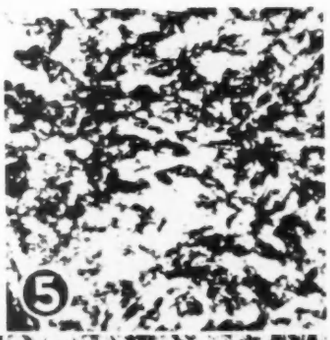
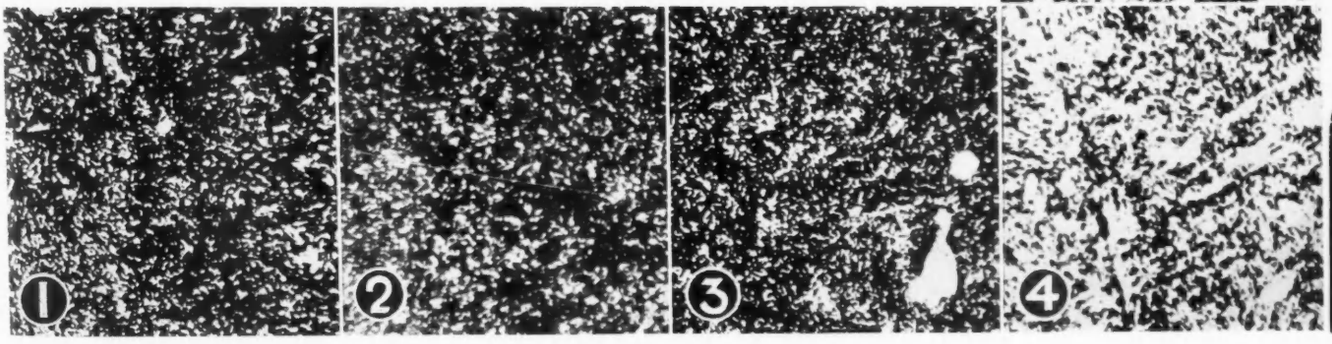


Fig. 3—Photomicrographs taken at surface and at various depths below the surface. Magnification, 1500.

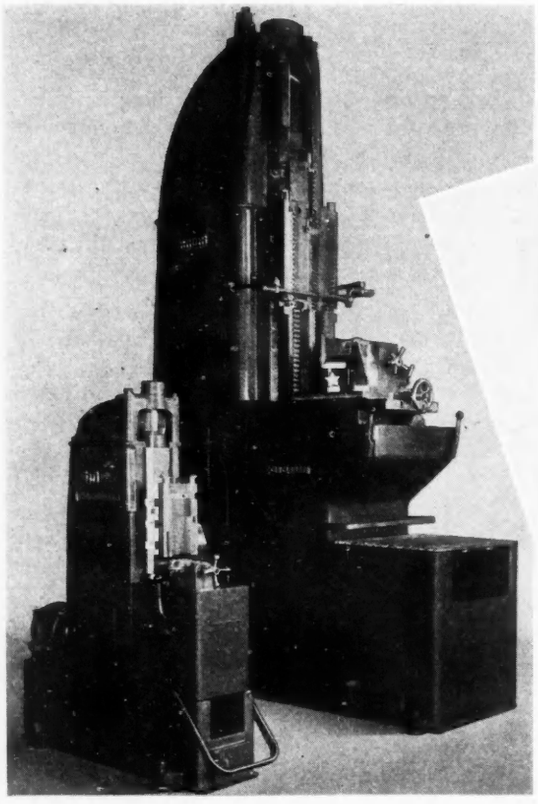
(1) At surface, 0.93 carbon, completely refined grain structure.
(2) 1/16-⅛ in. below surface, 0.75 carbon, completely refined martensite.
(3) ⅛-3/16 in. below surface, 0.54 carbon, junction of spheroidized martensite.
(4) 3/16-¼ in. below surface, 0.31 carbon, mainly ferrite and pearlite.
(5) ¼-5/16 in. below surface, 0.27 carbon, finely grained ferrite and pearlite structure.

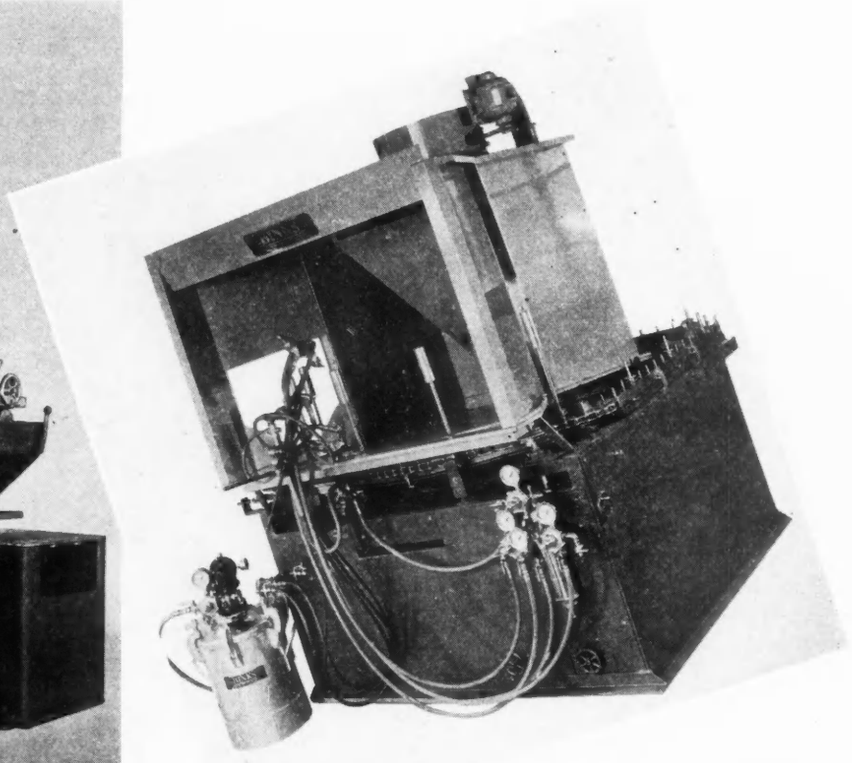


MATERIALS

Men and Machines . . .

J. R. Weaver Urges Machine Tool Builders to





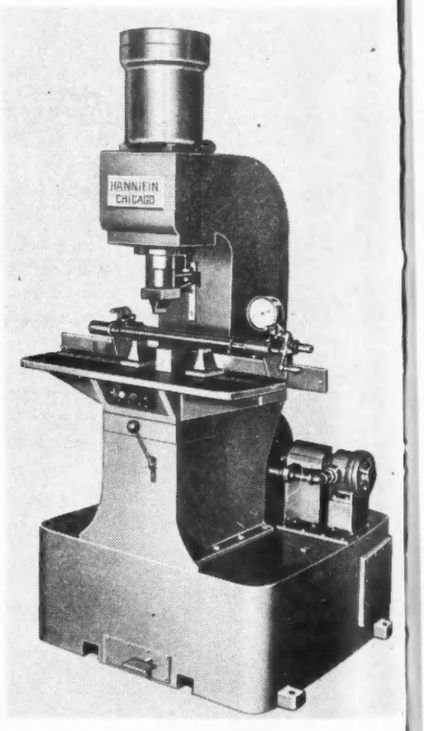
How many machine tool manufacturers realize what percentage of actual cutting or metal-removal time is obtainable from modern machine tools? J. R. Weaver, of the Westinghouse Electric & Mfg. Co., raised that question recently in an address presented before the Machine Tool Electrification Forum sponsored by Westinghouse. Following through on his own question, Mr. Weaver cited the results of a study made by his company which revealed that actual cutting time on many production machines ranges from 15 per cent to 30 per cent. The other 70 per cent to 85 per cent is used in setup time, loading and unloading time, tool maintenance, changing of feeds, speeds, etc.

Present trends toward more rugged construction to increase speeds and feeds of machine tools should, said Mr. Weaver, be supplemented by a thorough study of loading and unloading methods, proper location of feed and speed change levers, development of methods of changing feeds and speeds more quickly with less fa-

(Above, left)
Two single ram vertical hydro - broach machines which are part of Cincinnati Milling Machine Co.'s new line built in 12 standard sizes.

(Above)
Standard spindle type automatic spraying machine introduced by the Binks Mfg. Co.

(Right)
Hannifin straightening press with new pressure control which allows an unusually rapid operating cycle.



Make Thorough Study of Loading and Unloading Facilities, and Method of Setting Up Tools

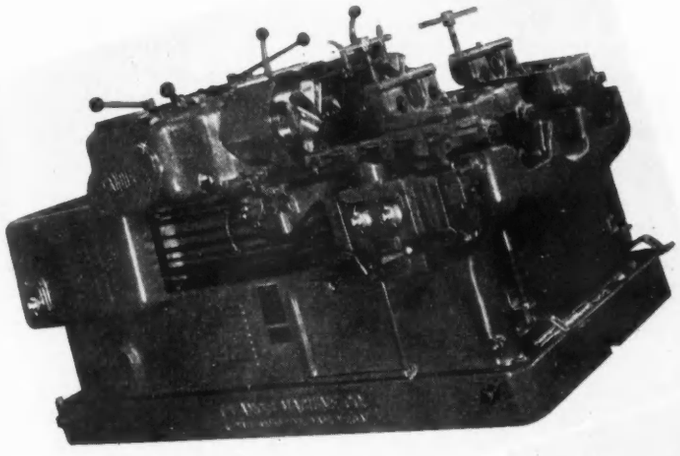
tigue, and improvement in the method of setting up tools.

With regard to the use of individual motors in machine tools, Mr. Weaver pointed out that the application of a motor and the control and wiring of the machine are the responsibility of the user. "If," he said, "the machine tool manufacturers could standardize on an adequate method of mounting the motor and completely wiring the machine in their own factories, it would contribute to more efficient operation of the machine as well as reduce the cost of installing the machine."

Mr. Weaver reported that Westinghouse has tried such a procedure with several of the machine tool builders with little success. He stated, "Sufficient thought has not been given to the wiring of the machine so that the wiring will conform to the safety laws of the state in which the machine is installed. Furthermore, trouble has been experienced in locating electrical difficulties in wiring. Also, in many cases, the wiring has been placed in inaccessible locations. The design engineer should give motor application full consideration at the time he is designing the machine. The motor and control apparatus should be included as an integral part of the structure of the machine. Then, the location of push buttons and control apparatus should be such that they be within easier reach of the operator and the entire installation be made accessible and easily maintained."

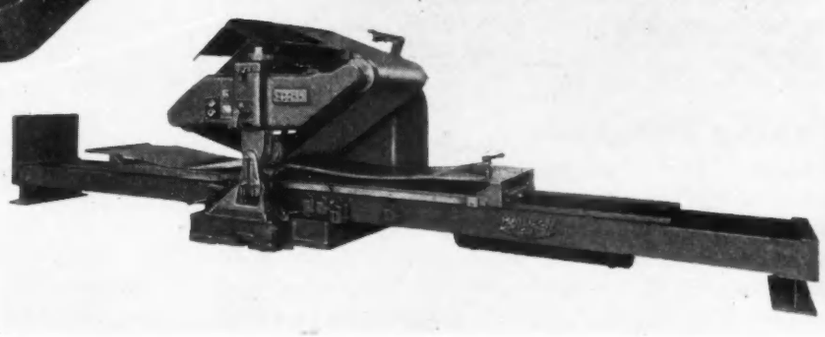
A new pressure control which allows an unusually rapid operating cycle has been developed by Hannifin Mfg. Co., Chicago, for use on hydraulic presses for straightening, forcing, press assembly and similar work. Operation of the control is as follows: Initial movement of the control lever (within the first inch of lever travel) moves the ram down rapidly, at nominal pressure. The ram will move down until it touches the work, and then stop. Movement of the control lever beyond the approach position causes pressure to be exerted by the ram, the working pressure being proportional to the distance the control lever is moved. Thus, any required working pressure at the ram, up to the capacity of the press, can be obtained merely by moving the control lever down. Releasing the control lever at any point automatically returns the ram to top position with a high speed return stroke.

According to the manufacturer, production straightening operations can be carried on faster, and with greater accuracy due to the simplicity and ease of handling of this new control. The sensitive pressure control differs from the conventional hydraulic press controls in which movement of the control lever governs the distance that the ram travels. In this new pres-



Improved hydraulically operated turning machine made by the Landis Machine Co.

Mattison wide belt sheet grinding and polishing machine especially designed for the proper application of factory coated abrasive belts to the grinding of stainless steel and other alloy sheets.



NEW DEVELOPMENTS

sure control the working force exerted by the ram is under direct and sensitive control, and ram travel is secondary, being governed by work resistance.

Working pressures produced at the ram are not only under sensitive and accurate control, but are plainly indicated on a dial gage reading in tons. The straightening press illustrated herewith is provided with an adjustable ram stroke, reducing the length of return stroke where the maximum gap is not required to accommodate the work. Unnecessary ram travel is eliminated.

The control is adaptable to many different types of hydraulic presses, and is said to be of special value in press assembly operations. With the gage indicating pressure exerted at the ram, an automatic inspection of sufficiently tight fit of parts being pressed into place is obtained. Limits of pressure required for any individual operation are easily determined, and the operator then merely observes the gage to make certain that the fit is sufficiently tight. Two adjustable hands on the gage can be set to indicate the maximum and minimum pressure limits. Parts too loose or too tight are plainly indicated by the pressures developed in forcing into position. An adjustable stop may also be provided to prevent exceeding the maximum pressure limit. An indicating light fixture may also be furnished.

The new model No. 455 wide belt sheet grinding and polishing machine built by the Mattison Machine Works, Rockford, Ill., is especially designed for the proper application of factory coated abrasive belts to the grinding of stainless steel and other alloy sheets. Construction adapts itself for quick application of

(*Turn to page* 716, *please*)

Production Lines....

Radiography

The next few years will mark some marvelous advances in the application of X-ray and radiography in general in the study of materials and important finished parts used in the automotive industry. Judging by what's in the offing, the surface has only been scratched at the moment. One of the oldest of the X-ray equipment manufacturers, whose interest in industrial applications is of but recent origin, tells us, confidentially, of an advance that will be noted within the next few months. This company is beginning production of a remarkable piece of equipment developed and perfected at M.I.T. It is a new cyclotron which may be rated at 2,000,000 electron volts, marking the closest approach to man-made radiation equaling the power of radium. Perhaps the biggest surprise is in the fact that this powerful machine will take only 3 x 7 feet of space.

Sans Horses

Punctuating the great wave of mechanization on American farms, the April issue of *Lubrication* (The Texas Co.) devotes its entire contents to the mechanized farm. In noting the lubrication requirements of farm tractors, this bulletin high spots some of the latest types of farm tractors now in production. This emphasis is significant in drawing attention to one of the most important of the activities of the automotive industry.

Taxing Progress

Recent report of the Machinery and Allied Products Institute indicates that the project to enact a federal law taxing machine tools still is very much alive. Background idea is that a tax on modernization would aid in supporting displaced workers. Despite all that has been done in recent years to demonstrate that production equipment is responsible for progress, despite evidence that machinery actually creates jobs, the enlightened philosophy has not yet penetrated the conscious thinking of people who have so much to do with legislation. The message of industry must carry on unabated in the interest of the public welfare.

Better Seeing

Some impression of what can be done to improve "seeing" in modern plants may be gained by a visit to the new factory recently built by Carboloy. All parts of the factory, except the Powdered Metal Department, are illuminated with 400-watt G. E. high intensity mercury vapor light units. These provide 40-50 foot-candles at the working plane, 25 foot-candles being considered as average. Alzak reflectors are used. The powdered metal department contains one of the first installations of the new 100-watt Cooper-Hewitt fluorescent lamps made especially for precision production operations. These lamps, too, provide 40-50 foot-candles at the working plane.

Preferred Numbers

Use of preferred numbers as an economical means of reducing the total number of variations in sizes, dimensions, and ratings of parts of every description is making slow but healthy progress in engineering circles. We commend a reading of the article by Prof. D. F. Miner in the April issue of *Industrial Standardization*, describing how the technique is used in the electrical field. Valuable commentary contributed by Prof. Miner is the flexibility of the system, the feasibility of combining several different series for major elements of a given part. Thus in establishing standards for fastenings, it has been found possible to use a "10-series" for the diameter, a "20-series" for length. The whole subject deserves the immediate attention of automotive engineers.—J. G.

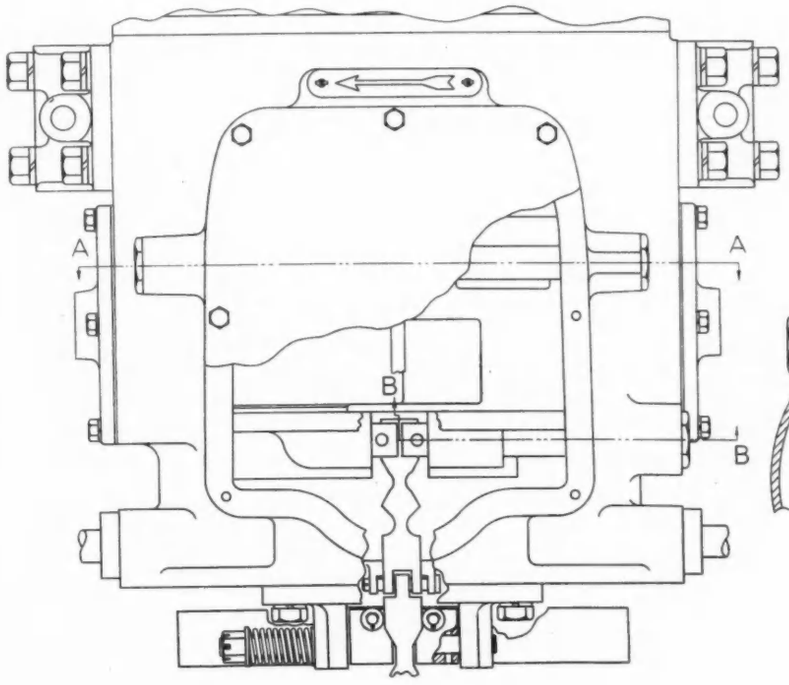
KERMATH-UPTON COMBINATION REVERSE and REDUCTION GEAR

MODEL RUA reverse and reduction gear developed by the Kermath Manufacturing Co. for use in connection with its marine engines has been used successfully on gasoline engines of 678 cu. in. displacement developing 225 bhp. at 2400 r.p.m., and on Diesel engines of 707 cu. in. displacement developing 160 bhp. at 1600 r.p.m.

Owing to the fact that the output shaft (or tailshaft) of the gear is concentric with the input shaft (clutch shaft), engines of different size and with various reduction ratios can have the same base dimensions and can be installed interchangeably on the same bed. The gear is produced with reduction ratios of 1.5, 2, and 2.5:1 as well as 1:1, without change in shaft alignment or overall length. Changes in ratio are obtained by merely changing two gears, the same housing, shaft and clutch being used in all cases.

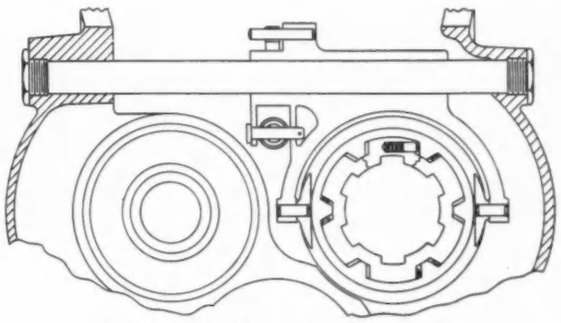
The gear comprises a mechanically-loaded multiple-disk clutch driven from a clutch drum mounted on the crankshaft or flywheel. The clutch shaft, which is mounted in ball bearings, carries the pinion of the first-reduction gears. The first-reduction pinion and reverse train drive gears at a ratio of 1.5:1, mounted on quill rollers on the lay shaft, which latter is mounted in ball bearings. The forward and reverse reduction gears are provided with jaw teeth which may be selectively engaged by a jaw clutch sliding on a lay shaft to provide the forward or reverse drive. On the rear end of the lay shaft is keyed the second-reduction pinion, which meshes with the second-reduction gear on the tailshaft. This latter is piloted in the end of the clutch shaft and is provided with a large thrust bearing at the rear.

Control of the gear is by a single lever. A cam on the control shaft operates the clutch-engaging yoke, while a short lever operates the clutch brake and the jaw-clutch mechanism. The clutch brake facilitates shifting. The jaw-clutch mechanism consists of a shifter fork actuated through a yieldable link. Movements of these parts are mechanically synchronized, so that immediately after the jaw clutch is engaged, the brake is released, and then the clutch is engaged. Should the jaw teeth "top," the yieldable link would permit clutch action to proceed and then complete the jaw-shifting operation after the clutch had started the gears rotating.

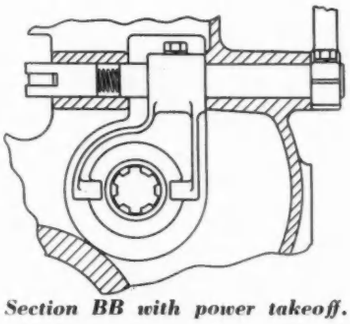


Top view of Kermath-Upton marine reduction and reverse gear, with a number of details: Section B-B with power take-off (below top view), Section A-A without power take-off (on right above) and Section A-A with power take-off (on right below).

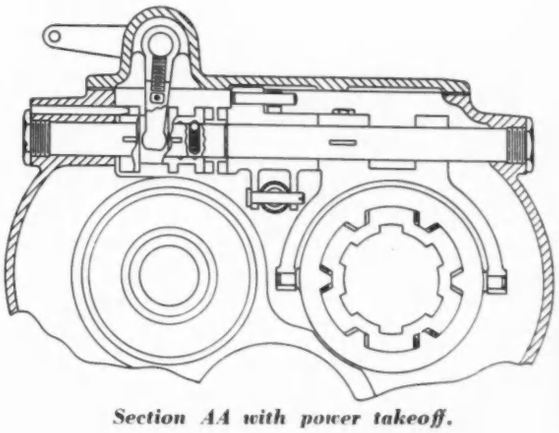
(Other views on the next page)



Section AA without power takeoff.



Section BB with power takeoff.

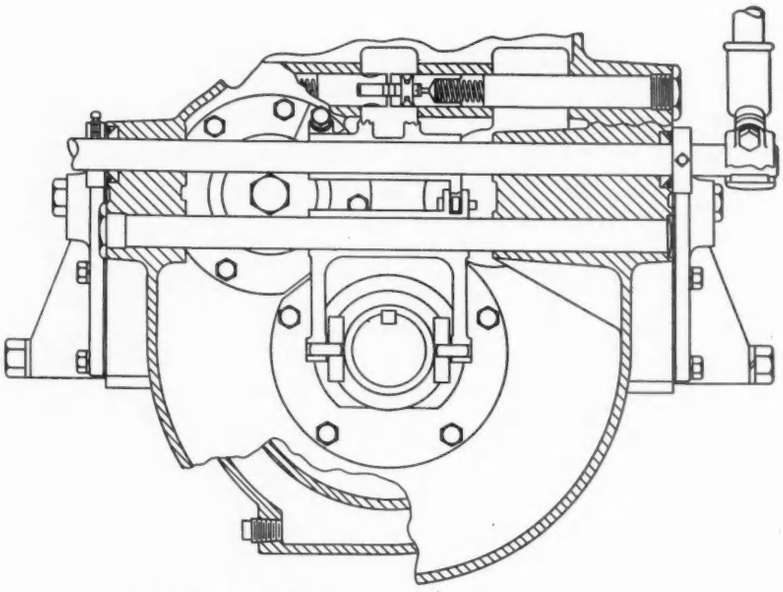


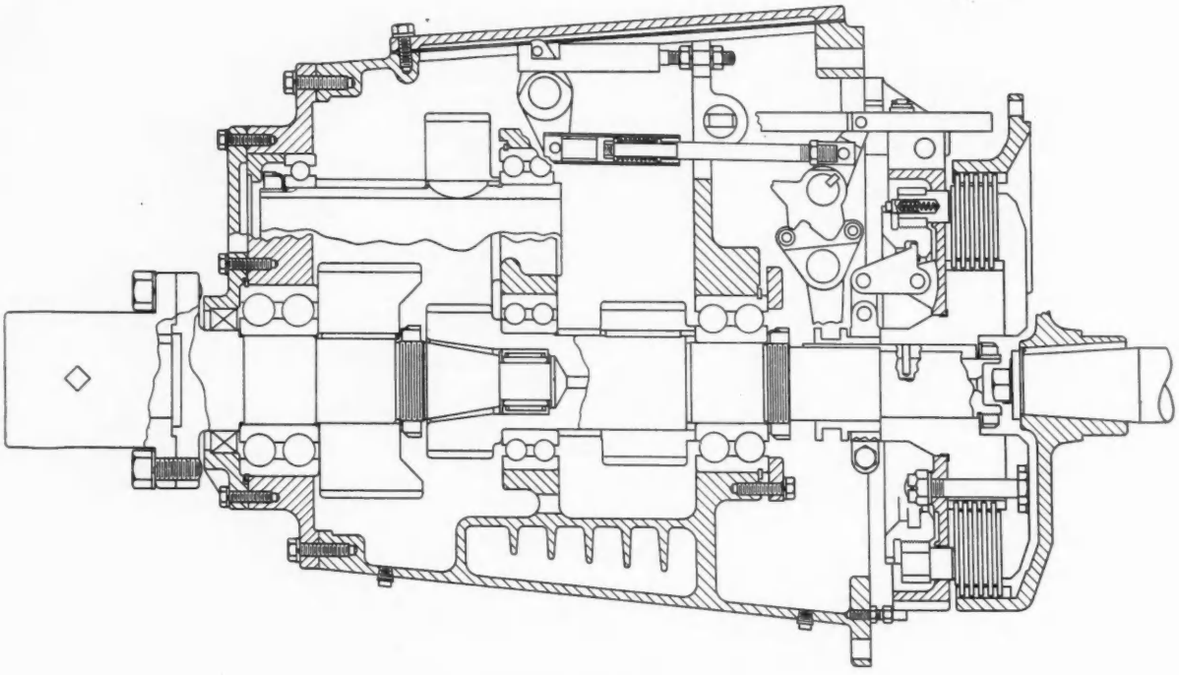
Section AA with power takeoff.

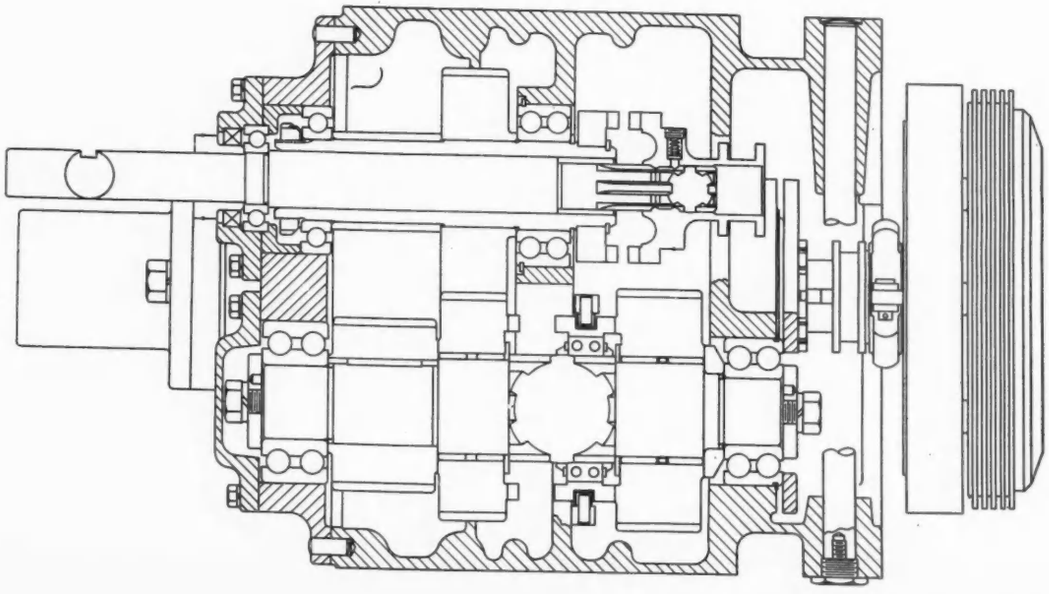
DESIGN

KERMATH-UPTON COMBINATION REVERSE and REDUCTION GEAR

See preceding page for other views







On this page are shown one transverse and two longitudinal sections of the reduction and reverse gear, the view in the center of the page being a vertical, and that at the bottom a horizontal longitudinal section. All three views show details of the control mechanism.

Girling Brake

with floating segment on trailing side

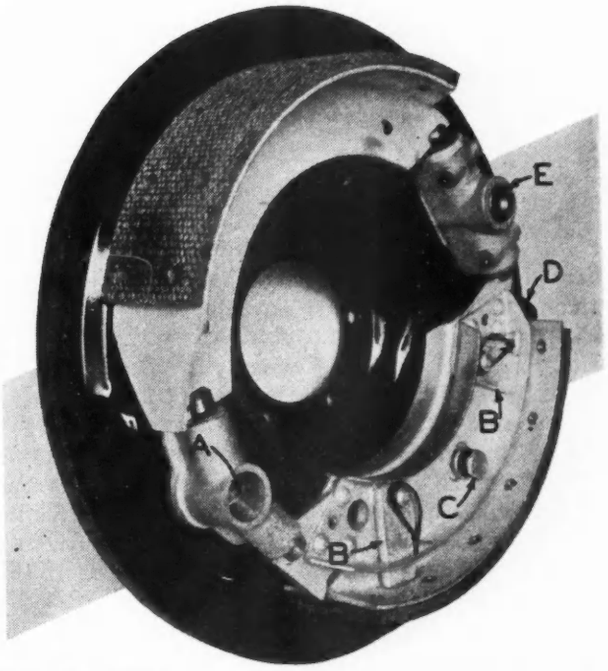
By M. W. BOURDON

GIRLING BRAKES, used on a number of British cars, have recently been made available in a new form on the two-leading-shoe principle, whereby the segment on the trailing side of the wedge type expander is given self-energizing effect corresponding with that on the normal leading side. This effect is gained by mounting a floating segment on a segmental carrier.

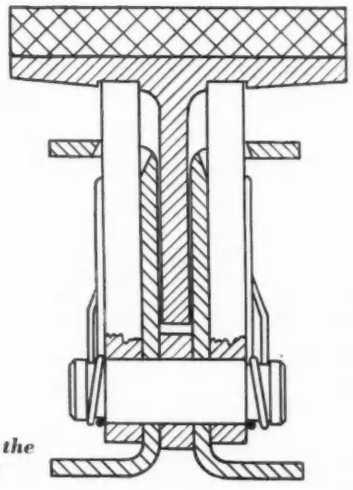
One shoe is of normal design, one end bearing against the usual Girling expander and the other against the adjuster. But the second shoe consists of two parts, the carrier and the floating segment, or shoe proper, with friction facing secured to it. The carrier consists of two L-section pieces riveted together with a distance piece between the ends to allow the web of the floating shoe to lie between them and be free to move relatively. The ends of the carrier—not those of the shoe—make contact with adjuster and expander.

Supporting the shoe against radial pressure when the brake is applied are two pairs of struts, pivoted on the carrier at their inner ends and bearing against the underside of the shoe, where their ends are radiused and located within shallow recesses. At the expander end of the shoe, attached to the backplate, is a stop to limit the rotational movement of the shoe in that direction, the direction of forward rotation of the drum.

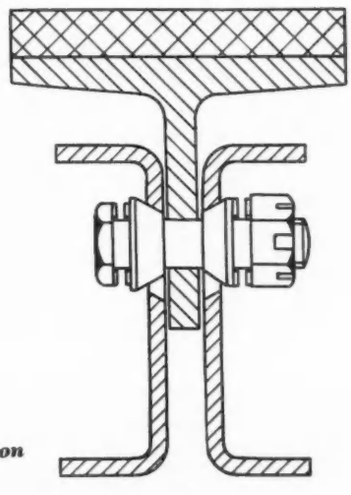
The shoe is held to the carrier by a central bolt, the holes in the carrier through which it passes being elongated and having beveled edges. The latter, in conjunction with spring-loaded cones on the bolt, pull the shoe inward, onto the struts, but permit limited relative movement in all directions of the web of the shoe within the halves of the carrier.



View of the Girling brake in which A is the adjuster; B the struts; C the locating bolt for carrying the spring-loaded cones; D the stop on the back-plate and E the expander



Section showing the pivoted struts



Section showing the location of the bolt and cones

When the brake is applied, the frictional drag of the drum carries the shoe against the stop, while the struts, having radiused ends, cause the relative radial positions of shoe and carrier to remain unchanged, despite the shoe moving relatively in a rotational sense.

Upon the shoe being held against further rotational movement at its leading end, by making contact with the stop, the latter becomes the fulcrum point, and the self-energizing effect of a normal leading shoe is gained. Each strut, it may be added, has a simple hairpin spring so disposed as to carry the strut in the same direction as the drum, with forward rotation, carries the floating shoe.

When the drum is rotated in the reverse direction, relative rotational movement between carrier and shoe is limited by the central bolt.

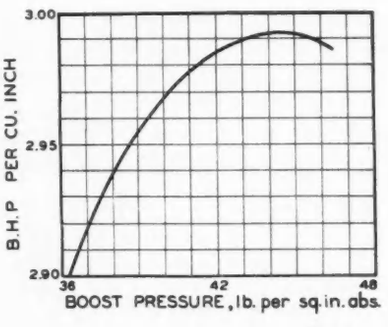
Aircraft, Diesel and

High Output European Engines

W. P. RICART and Sandro Sirtori of the Alfa-Romeo Company, Milan, Italy, in a paper entitled "Some European Comments on High-Output Automobile and Aero Engines," said that it is now possible to predetermine the cylinder size for maximum specific output for any type of fuel. However, the cylinder dimensions giving the best power/weight ratio are very different from those giving the maximum power/displacement ratio. They expressed the opinion that current practice in the design of high-output aircraft engines was in for a thorough revision and that future high-output aircraft engines operating on 100-octane fuels and with a high ratio of supercharge would have cylinders of not more than 120 cu. in. displacement each.

If the highest output per cu. in. displacement is the object, the cylinders must be much smaller still. If an alcohol fuel containing a large proportion of methyl alcohol and acetone is used, the best compromise between high b.m.e.p. high speed, and high mechanical efficiency is obtained with cylinders of between 9 and 15 cu. in. displacement. Any change in the character of the fuel changes the optimum supercharge ratio and necessitates a revision of all of the other variables of the design.

Some data were given in the paper of the Alfa-Romeo eight-cylinder 91½ cu. in. racing engine developed last year. It develops a maximum b.m.e.p. of 285 lb. per sq. in. and in excess of 2.46 hp. per cu. in. displacement at nearly 8000 r.p.m. with an absolute inlet pressure of 33.5 lb. per sq. in., produced by a Roots blower running at 1.32 times engine speed. The cylinders have a bore of 2.28 and a stroke of 2.76 in. As is usual in racing engines, the valves are located in the cylinder heads. The latter are of aluminum alloy and the valves seat directly on this alloy, which is a new development that has given satisfactory results for racing work. Crankshaft main bearings are babbitt-lined and have a rubbing speed of 4300 ft. per min. Connecting rod bearings are of the roller type and are plentifully supplied with oil to cool the rollers. The large amounts of oil thrown off by the crankshaft have been the cause of some trouble with the spark plugs used (a very "cool" type specially developed for high-speed engines) which would become fouled with oil. It took some time to master this difficulty. In its present state of development this little engine gives about the same sensation as a normal sports engine at moderate speeds, but when a speed of 4500 r.p.m. is exceeded it begins to "show its sporting blood."



Specific output of engine with 11.4 cu. in. cylinders at 9000 r.p.m. The engine is equipped with a Roots-blower type of supercharger.

Alfa-Romeo at present is developing new engines designed to operate at higher speed and greater b.m.e.p. Each cylinder of a 16-cylinder, 135-deg. V engine has four valves in the head, and each valve has four springs of a special design. Sodium-cooled 1-in. valves with hollow heads have been developed. Where a high degree of supercharge is to be employed it is necessary to revise all of the elements of the induction system with the object of preventing the adiabatic efficiency of the blower from becoming too low. Fig. 1 represents results obtained with a particular design of cylinder of 11.4 cu. in. displacement and normal blower and inlet systems. This represents substantially the limits of supercharge obtainable with present equipment.

Turning to a discussion of international racing rules, the authors gave it as their opinion that the present limit on engine displacement had ceased to serve any useful purpose. Some voices, they said, had been raised in favor of a return to the 1½ liter (91½ cu. in.) limit for Grand Prix racing engines. Continuance of the present racing rules for too long a time, they averred, would serve merely to increase the divergence between practice in racing engines and that in the design of modern automobile and aircraft engines. Limits on consumption and maximum weight might serve a useful purpose in that they would turn the thoughts of designers into more practical channels, whereas a continuance of the present regulations would result in the production of very expensive microscopic engines for which there can be no practical application.

Where 100-octane fuel is to be used in aircraft engines, a compromise must be made between the maximum power/weight ratio for take-off purposes and high fuel economy in cruising at 10,000 to 12,000 ft. altitude. Where there is energetic cooling of

European Engines

Were among the subjects discussed at the World Automotive Engineering Congress. Here are digests of some of the papers presented

both the cylinders and heads, the authors for aircraft engines favor cylinders of not more than 5 in. bore and not more than 120 cu. in. displacement. Piston speeds have been raised to 2800 ft. per min. with very high boosts. The connecting rod bearing is likely to be the weak link and should be given careful study. A b.m.e.p. of 250 lb. per sq. in. is beyond the practical limits if a satisfactory degree of reliability is to be ensured.

The authors believe that under present conditions a maximum output of 0.95 hp. per cu. in. is obtainable immediately for short periods from engines of this type, and that this figure can be further increased by development work. Laboratory tests are said to have shown an output as high as 1.6 hp. per cu. in. from an engine of this type.

For the larger engines which the aircraft industry will call for in the near future, a larger number of cylinders of the dimensions mentioned would be required. The use of more than 18 cylinders has been proposed, but their cooling requirements involve difficult problems. Up to 2000 hp. the double row radial engine with 18 cylinders is practical. High boost pressures can be employed in such engines if all hot spots are eliminated, but the authors expressed the view that air-cooled cylinders would be seriously handicapped in this respect even with the most ingenious baffles and ducts.

The authors had a good word to say for the sleeve-valve development in England by the Bristol company, but expressed the fear that it had come some years too late.

At present the principal limit on the specific output of aircraft engines is the thermal stress on pistons and rings, and these necessarily would be further increased by the interposition of a sleeve and another oil film between the pistons and the cylinders, especially if the sleeve were made of austenitic steel.

Lubrication of Aircraft Engines

ARTHUR NUTT, vice president of engineering of Wright Aeronautical Corporation, presented a paper on Aircraft Engines and Their Lubrication. By way of illustrating the progress made in aircraft engine design during the past 14 years he showed curves of the increase in take-off horse power, b.m.e.p., and r.p.m., and the decrease in weight per horsepower of the single-row Wright Cyclone engines during this period. The take-off horse power increased from 400 to 1200 hp., the b.m.e.p. at take-off hp. from 128 to 209 lb. per sq. in., and the r.p.m. at take-off from 1900 to 2500, while the weight per horse power decreased from 2.2 to 1.1 lb.

The increased performance represented by these figures resulted from improvements in cooling, supercharging, vibration-damping, spark plugs, fuels, oils, dynamic suspension, and materials. These improvements were discussed in the paper in some detail. The author also discussed such other timely aircraft powerplant problems as compression-ignition vs. spark-ignition engines, fuel injection in spark-ignition engines, co-axial propellers, liquid coolng vs. air-cooling, engine types, sleeve-valve vs. poppet-valve engines, and lubrication.

The author said that while modern engines will operate on the oils which are made to the very inadequate oil specifications in general use in this country and abroad and will give satisfaction, if better oil were available these engines could be operated more hours between overhauls and the servicing cost could be reduced. There is no question, he said, that improved oils can be produced, as a number of them have been developed during the past few years, and if the oil industry will supply their very able research engineers with the necessary research and production equipment, even better oils could be made available.

As a result of the introduction of a new set of oil specifications by the Wright Aeronautical Corporation some three years ago, there are now available a number of lubricating oils which are a definite improvement over earlier oils. According to one specification, "only refined petroleum oils without mixtures of fatty oils, resins, soaps, or other compounds will be accepted, unless otherwise ordered." However, in order not to completely exclude compounded oils, in another specification relating to engine tests of lubricating oils, there is included a statement to the effect that, "Failure to satisfy current specifications, including the W.A.C. oxidation test, shall normally be sufficient to warrant rejection of the oil proposed for test. Any

exceptions to this practice must be supported by convincing evidence of merit if approved."

There is an impression in some circles that American aircraft engines are inferior to similar European engines, but in the author's opinion this impression is erroneous and based on differences in methods of rating engines. It is the practice in this country to test engines at sea level at the same power at which the engine is rated at altitude, provided the altitude is not too high, and if such is the case, then it is customary to revert to two-speed superchargers, as the single-speed, high-altitude engine does not give sufficient performance at sea level. On the other hand, under the recently revised test procedure of the French Air Service, the major portion of the test is at 90 per cent of sea-level power, which permits the engine to run at approximately three-quarters horse power for the test. The engine is rated in service at 100 per cent power. The German rating practice is quite similar.

Aircraft Propeller Vibration Problems

WITH the advent of metal propellers and larger aircraft powerplants, propeller failures were experienced under operating conditions which seemed to involve quite conservative design stresses. From the nature of the fractures and on other grounds it was concluded that some vibratory phenomenon was responsible for these fatigue failures. Because of the seriousness of propeller failures, Hamilton Standard Propeller Division undertook an intensive study of the entire propeller-vibration problem, and this study and its results formed the basis of a paper presented by Charles M. Kearns, project engineer of the Division.

Owing to the complication of the vibratory system, a complete analytical treatment seemed hopeless, hence a strain gage was devised by means of which the actual vibrations of propeller blades in service could be recorded. In its final form this strain gage became a strip of strain-sensitive carbon which could be calibrated on a vibrating beam and transferred to the surface to be studied. It is attached to the propeller blade by a thermo-plastic resin having sufficient bonding ability to make possible measurements in centrifugal fields of 8000 gravity. The gage is attached to the propeller blade at a point whose vibration is to be studied and fine lead wires are run underneath protective tapes from the gage to the electrical collector rings which are necessary to complete the electrical circuit.

The strain gage is so connected that as the blade is strained during a vibration, the alternating resistance change produces an alternating voltage which can be amplified and measured. From a knowledge of the gage calibration and amplifier sensitivity, an electrical output indication can be converted into vibratory stress. Because of the frequent coincidence of several vibratory modes, the stress-time function is usually nonsinusoidal, so that a permanent oscillographic record is usually made for each stress measurement. A careful analysis of such an oscillogram then yields the harmonic components of the stress wave, as well as its complete stress range.

As background in experimental studies began to accumulate, it became evident that simultaneous measurements at many points on the propeller and engine were desirable and as a result the research equipment now in use consists of a 12-element recording oscillograph with a bank of amplifiers to drive the several elements. A photograph of the recording equipment and a sample vibration record are shown in Figs. 1 and 2.

In addition to propeller stress measurements, it is usually necessary to measure either the vibratory motion of the engine in space or the crankshaft torsional vibration, or both, in order to understand the modes of motion involved and to determine the nature of the possible solutions of the problem.

Because of the extreme complexity of vibratory systems and the unpredictable influence of changes in the engine-propeller system upon the vibration characteristics of the whole, it has been found necessary up to this time to measure the vibration stress characteristics of every proposed combination of engine and propeller before it is applied to the airplane, and it now appears necessary that the combination be checked afterward.

In some of the cases in which undesirable propeller stresses were found associated with marked torsional crankshaft vibration, a change in the existing dynamic damper or the introduction of a centrifugally-tuned damper has resulted in a marked and satisfactory decrease in the propeller-stress situation.

As a result of rapidly growing experience, it seems

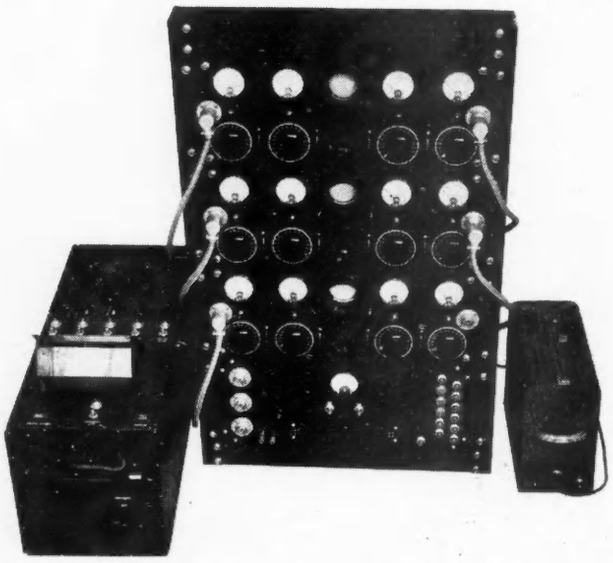


Fig. 1—The recording equipment used in the Kearns study

that the only ultimately-satisfactory solution of the propeller-vibration-stress problem lies in completely isolating the engine and the propeller from each other, except for a torque-transmitting coupling of such flexibility that alternating torques above the engine one-half order cannot be transmitted to the propeller. It is also very important that the propeller be isolated from the engine as regards both lateral disturbances and torque fluctuations. In the case of engines in the wing with extension drives to the propeller, this seems to be a practicable thing to do. In the case of radial engines, the present interest in extension nose drives offers space and constructional possibilities for accomplishing the same results. However, in the case of radial engines of conventional design the difficulties of providing such isolation are very large.

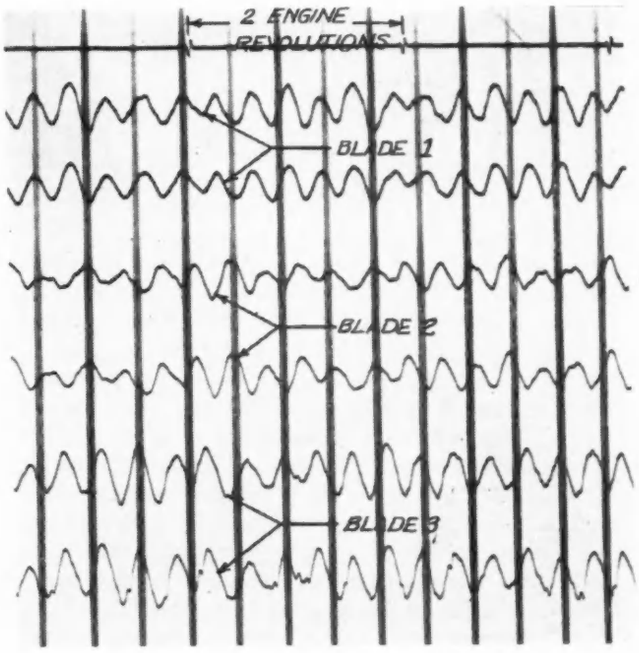


Fig. 2—Sample vibration record showing the curves of three propeller blades

Diesel Engine on the Railroad

SOME interesting data on the use of internal-combustion engines in railroad work were given in a paper by A. R. Walker, electrical-equipment engineer of the Illinois Central System. Between 1923 and 1929 there was a rapid increase in the number of railcars in service on American railroads, from 130 to 900. The increase in this type of equipment then eased off, and by 1938 the number had risen only to 1040. Quite different was the introduction of Diesel switching locomotives—slow at first and very rapid during the past few years. As late as 1929 only twelve such locomotives were sold to American railroads; in 1930 the number increased to 28, but during the depression years it dropped again, and in 1935 only 11 were sold. Then came a rapid rise, to 42 in 1936, 80 in 1937, and 92 in 1938. Up to 1938 a total of 490 switching locomotives had been sold, of an aggregate horsepower of 290,000.

A graph of the savings effected by Diesel switching locomotives over steam switchers, month by month, for the four years 1935-8, inclusive, showed an average of about $1.80 per locomotive per hour. The savings varied a great deal, from a maximum of $3.10 in March, 1936, to a minimum of $0.50 in January, 1938. Another graph showed the variation of passenger train-miles during the period from 1929 to 1938, inclusive, and the increase in Diesel train-miles from 1934 on. Passenger train-miles of American railroads decreased at a fairly uniform rate from 575 million in 1929 to 387 million in 1933 and have remained nearly constant since, the figure for 1938 being 400 million. Diesel-engined trains first came into use on American railroads in 1934; the number of Diesel train-miles has increased from year to year, and in 1938 it was nearly nine million.

As to the future of the Diesel engine in railroad work, Mr. Walker gave it as his opinion that within a few years practically all switching service would be performed with it. As approximately 12,000 locomotives are employed in switching service, this offers a big field for the Diesel engine. He also believes that Diesels will replace steam engines on the majority of branch-line trains and on many "through" passenger trains, but he does not expect to see many in "through" freight service.

In addition to locomotive service, there is a possibility that thousands of Diesel engines of all types and sizes will be used on the railroads in powerplants, water-pumping stations, trucks, buses, tractors of all kinds, locomotive cranes, shovels, ditchers, rail-laying machines, and many other kinds of equipment. As the characteristics of the Diesels are improved to better meet the varied requirements of all this equipment, we can expect more and more of them to be used.

Malleable Iron in Automotive Production

THE first use of malleable iron in automotive production was in hubs, according to Enrique Touceda and James H. Lansing of the Malleable Founders' Society of Cleveland. Satisfactory experience with the material in these parts led to further applications, such as in rear-axle assemblies, differential carriers, cases, bearing caps, brake supports, steering-gear housings, steering-gear brackets, spring hangers, spring clips, bumper brackets, brake and clutch pedals and brackets, wheel carriers, and various body parts. Malleable iron has been used also in shock-absorber parts, radiator fittings, exhaust-pipe flanges, generator and fan assembly supports. Truck manufacturers, in addition to the applications already mentioned, also use malleable iron in frame members and rear-axle housings. The properties that specially recommend malleable iron for these uses are its shock and corrosion resistance and its good machinability.

The authors gave an outline of the major steps in the production of malleable iron castings, the various types of furnace used, and metallurgical considerations and developments.

MEN and MACHINES....

(*Continued from page* 708)

belts, and the belt is automatically controlled and oscillated on the rolls. Push button stations and controls for tables are located at the front of the machine for easy access by the operator. Contact rolls are removable and rolls of any degree of cushion may be substituted according to the nature of the work.

This machine can be furnished in various widths and lengths. Machines are built to carry belts up to 40 in. or 50 in. wide, processing sheets up to 36 in. or 48 in. wide and 10 ft., 12 ft., and 14 ft. long.

A number of improvements have been made recently in the hydraulically operated turning machine which was first introduced in June, 1937, by the Landis Machine Co., Waynesboro, Pa.

The hydraulic cycle of the improved "Lanhydro" turning machine has been made more flexible to suit every kind of material and cutting condition, and the operation of the machine has been greatly simplified. The operating cycle is now controlled by a foot pedal which leaves the operators hands free for loading and unloading the vises or work holding fixtures.

Now, as the cycle is completed, the work is removed from the vise or holding fixture and another piece is inserted but not clamped. The operator immediately depresses the foot pedal, shown in the illustration, to start the cycle. The carriage then advances rapidly to a position where the work is about to enter the work center which is located within the bore of each turning head. The work center protrudes beyond the face of the turning head. At this point the forward movement of the carriage is checked to a very slow forward speed to permit the operator to guide the work into the work center after which he performs the final clamping operation.

The position at which the fast forward speed of the carriage is checked is made adjustable for jobs of different lengths. The slow forward movement for centering and clamping the work is also made variable. After the work is clamped, the carriage again advances rapidly to the position where the work enters the turning head. A coarse feed is then used throughout for the turning operation. This coarse turning feed is made variable so that it can be adjusted to suit any material or turning speed.

If the work is of a nature that a shoulder must be faced, the cycle is so arranged that the carriage will advance under a fine finishing feed after it reaches a position within 0.008 in. or 0.010 in. of the shoulder. This fine finishing feed, like the slow turning feed, is also variable. The carriage advances under this fine finishing feed to a definite stop and at that point a variable dwell period is provided for the final clean-up cut which makes it possible to hold the work to extremely close limits in length. After the dwell period, the turning head opens and the carriage returns rapidly to the starting position to complete the cycle. The turning head automatically closes as the carriage returns.

This improved hydraulic cycle greatly increases the flexibility of the machine and makes it applicable to a wider variety of turning operations in addition to simplfying its operaton.

A new line of single ram vertical hydro-broach machines has been announced by the Cincinnati Milling Machine Co., Cincinnati, Ohio.

Built in 12 standard sizes, from the No. 1-18 with an 18-in. ram stroke and 2000 lb. normal broaching force to the No. 15-60 with a 60-in. ram stroke and 30,000 lb. broaching force, the single ram hydro-broach machines are obtainable in both the fixed and the receding table types. Special sizes of these machines can be supplied.

The standard fixed table machines are built for single cycle operation and the ram stops at the end of each stroke. Completed work is removed at the end of the cutting stroke and new work is placed in the fixture while the ram is stopped at the top of its return stroke.

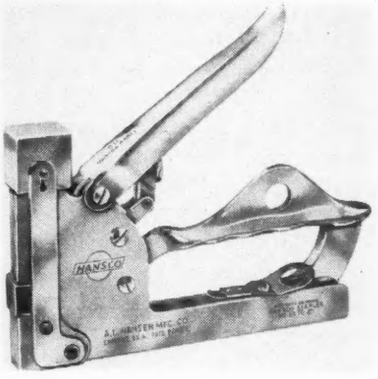
Either full automatic or single cycle operation may be arranged with the receding table type machine. Work is loaded, in the full automatic cycle, as the ram returns to the starting position following the completion of the cutting stroke. The table advances to the broaching position, the ram makes a cutting stroke, the table recedes and the cycle repeats itself.

For single cycle operation of the receding table type machine, the ram is stopped at the top of the return stroke and the operator unloads and loads the work.

Both types of machines, regardless of the operating cycle, may be stopped instantly by shifting the hand levers at each side of the operating station or by stepping on the foot treadle. Instant reversal by means

The Hansco Tacker

Here is a photograph of the Hansco tacker which was described in the June 1 installment of* MEN AND MACHINES, *page 690. Known as model T-2, this compact device is used in the upholstery divisions of many automotive plants for tacking on upholstery and covering materials. A. L. Hansen Mfg. Co., Chicago, manufactures the product.



NEW DEVELOPMENTS

of the dual hand levers is also provided. Both features are aids during set-up operations.

An exclusive latch device returns the table to broaching position within 0.0003 in. on both full automatic and single cycle operation of the receding table type broach.

A new standard spindle type automatic spraying machine is being currently introduced by the Binks Mfg. Co., Chicago. The machine utilizes the newly perfected Binks Thor model No. 21 automatic spray gun connected with a three-way valve that shuts the gun on and off. In this way the gun sprays only when it is following the revolving products to be finished.

The Binks company has also announced the production of a complete one-piece streamline extension spray gun, known as the "Thor Model No. 23 Spray Gun." The gun was designed primarily to allow the operator to apply paint directly to surfaces that are usually out of reach of an ordinary spray gun. Made of special alloy metal, the new Thor No. 23 is exceptionally light in weight and easy to handle. All parts are encased to prevent damage in handling. A conveniently-placed knurled screw, directly behind the nozzle head, controls the width of the spray.—H.E.B., Jr.

Publications Available on Machine Tools

Hannifin Mfg. Co., Chicago, has brought out two new bulletins. No. 47 contains a description of the company's newly-developed **finger-tip pressure control for hydraulic presses.** No. 46 describes the Hannifin **pneumatic arbor presses.***

A catalog issued by Schramm, Inc., West Chester, Pa., presents the company's complete line of "Utility" **stationary air compressors** for industrial application.*

Bulletin No. 71-G illustrates and describes series 100, 10, and 500 **power squaring shears** manufactured by the Niagara Machine & Tool Works, Buffalo, N. Y.*

"Facts About Grinding Wheels" is the title of a useful booklet published by the Norton Co., Worcester, Mass.*

Joseph T. Ryerson & Son, Inc., Chicago, has brought out a leaflet entitled **"Average Physical Properties of Various Steels."** It presents a compact chart giving tensile strength, yield point, elongation, reduction of area, hardness, and other average physical properties of nearly 50 different types of steels.*

Gisholt Machine Co., Madison, Wis., has prepared performance data sheets which show actual photographs of Gisholt machines at work on regular as well as unusual machining jobs, outline the problems and tell how each was solved. Tool layouts show how the job was set up and the various operations are described, stating speeds, feeds and time required. The sheets are offered in an attractive binder and entitled **"Performance Data."***

Wittek Mfg. Co., Chicago, describes its line of **roll feeds for punch presses** in bulletin No. WF-339.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

Electrically-Conducting Tires

In a recent issue we printed an item based on a French source, to the effect that the Dunlop Rubber Company had developed a pneumatic tire with relatively high electrical conductivity that would effectively "ground" the vehicle to which it is fitted and thus protect persons against shock when entering, etc. Additional information on this subject was given by C. D. Law of the Dunlop Rubber Company in a paper read before the Institution of Automobile Engineers. Such "grounding" tires are needed particularly on trolley buses, as the electrical installations of these buses occasionally develop leaks to ground, and passengers and others then run the risk of severe shocks when touching metallic parts of the bus.

It appears that these "conducting" tires have been used for some years on the tail wheels of airplanes to carry off the electrical charge accumulated on the plane during flight, when a landing is made. The electrical resistance of the human body is of the order of 50,000 ohms, and if a "grounding" line of no more than 5000 ohms can be provided, most of the charge will pass through this ground connection.

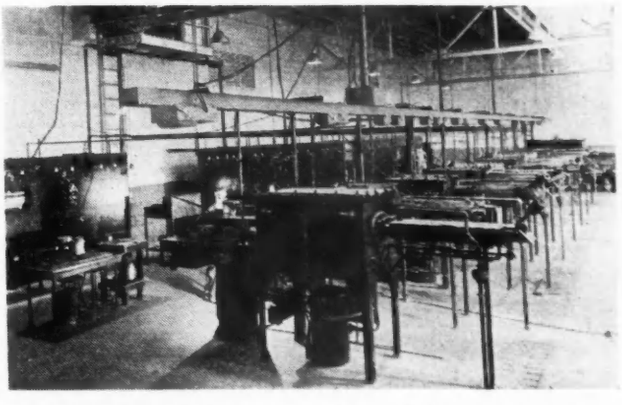
Tires are given electrical conducting qualities by the use of specially compounded tread and wall rubber. The change from the ordinary rubber compounds is relatively small, and the essential physical properties, such as resistance to wear, cutting, etc., are not materially affected. However, the special compounds have an electrical conductivity about one-million times as great as that of the ordinary compounds, the specific resistance being approximately 50 ohms as compared with 50 million. Tests carried out on a trolley bus with a dummy representing a person having an electrical resistance of 50,000 ohms showed that the current passing through the dummy was reduced by 80 per cent on dry concrete road, and more on wet road.

Carboloy Opens New Plant

This month Carboloy Co., Inc., opened a new plant in Detroit which combines all of its facilities for the manufacture of cemented carbide products which were formerly divided among Carboloy plants in Cleveland, Detroit, and Stamford, Conn. Equipment now installed and planned for the immediate future is said to be capable of producing about 10 times the present amount of Carboloy currently consumed by industry.

The accompanying photograph shows the furnace room of the new plant which is equipped at present with a battery of 18 electric furnaces for reduction, carbonizing, semi-sintering, sintering and brazing processes, having a capacity of several million grams monthly. An overhead air filter is installed to prevent contamination of powdered metals. Many of the furnaces have such features as stoking units and controlled heating and cooling cycles.

General offices of the company also are located on the new site on East 8-Mile Road, one quarter mile east of Van Dyke, just beyond the outskirts of Detroit.



Furnace room of the new Carboloy plant in Detroit

DEEPHARD PROCESS

(*Continued from page* 705)

of the carbon into the core and good bonding between the hardened surface and core. This is illustrated by Fig. 4, which shows a gear made of SAE 4615 Five-Point Deephard steel that has been subjected to a test to destruction. It is asserted that if it were not for this good bond between the hardened surface and core, the distortion which the gear withstood before it fractured would have been impossible. When the teeth finally fractured, each fracture extended into and clear through the core.

Metallurgically, the hard surface layer consists of a hypereutectic steel of uniform hardness and grain structure over two-thirds of its full depth. The transition to a hypoeutectic composition is gradual and extends over a layer equal in depth to the file-hard hypereutectic zone. (Fig. 1.)

COMPARISON OF Five-Point Special Alloy and SAE 4340 Steel

	Brinell	Core Brinell	Surface Brinell	Tensile Strength Lb. per Sq. In.
SAE 4340 Sample of 1.3 in. Dia. Drawn at 800 deg. Fahr., just beyond the brittle range	440			220,000
Five-Point Special Alloy, 1.25 in. dia.		360-375	614-712	190,000

While the Five-Point Deephard steel process is applicable to all SAE low-carbon steels, Foote Bros. Gear and Machine Corporation has collaborated with a large steel mill in the production of a special alloy steel which when treated by its Five-Point Deephard process is said to give in a commercial steel the optimum combination of surface hardness and strength. It is a nickel-molybdenum steel which after processing shows the following core properties for a 1-in. round specimen.

Yield point	156,000 lb. per sq. in.
Ultimate strength	216,000 lb. per sq. in.
Elongation in 2 in.	11 per cent
Reduction of area	29.8 per cent
Izod impact value	25
Brinell hardness of surface	725
Brinell hardness at ¼ in. depth	495
Brinell hardness at core	429

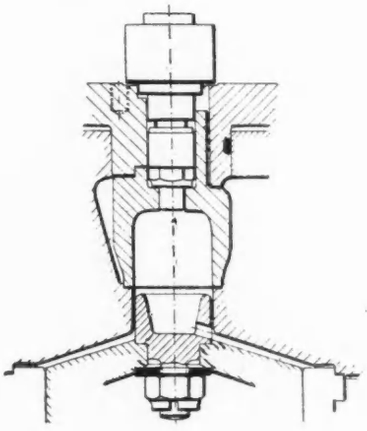
The steel showing the above core properties is known as the Five-Point Deephard steel special alloy. While tests of this steel have not yet been completed, the results so far obtained indicate that it will permit higher surface hardnesses than obtainable with high-carbon alloy steels having a Brinell hardness of 275-325 with almost equal strength. It is claimed that with a core hardness of 360-375 and a gradual increase from this to a surface hardness of 614-712 Brinell, this special alloy steel shows beam and shear strengths close to those of the strongest alloy steels, and a degree of surface hardness higher than what is practical with these steels. This is illustrated by the accompanying comparison between Five-Point Deephard steel special alloy and SAE 4300, made by the sponsors of the process.

We are informed that experiments with steels treated by the new process are being continued and that additional wear and other tests are being made.

At the present time marketing efforts are confined to the sale of finished products which have been machined by Foote Bros. Gear & Machine Corp. and processed by it with its Five-Point Deephard steel process.

Orenstein and Koppel Diesel Engine

IN this engine, manufactured in Germany, the piston has a conical head, into the center of which is secured a cup-shaped member which toward the end of the compression stroke enters the cylindrical precombustion chamber from below. The air which is being compressed by the piston thereafter enters the precombustion chamber through tangential passages



at the bottom of the cup-shaped member. Thus a swirling motion is produced in the air in the precombustion chamber, into which the atomized fuel is injected axially. After ignition, the contents of the precombustion chamber are forced through the passages of the cup-shaped member into the cylinder and there produce a swirling motion in the opposite direction. Starting of this engine is claimed to involve little difficulty, and the injection pressure is only 16,000 lb. per sq. in.

These engines are being produced in one-, two-, three-, four-, and six-cylinder models, all operating at 1200 r.p.m., with a compression ratio of 17. The compression pressure is 590 lb., the maximum combustion pressure, 800 to 900 lb., and the b.m.e.p., 81 lb. per sq. in. The engines have a bore of 551 and a stroke of 7.87 in.—*Deutsche Motor Zeitschrift.*

Synthetic Rubber-Like Materials

(*Continued from page* 702)

xylene will attack both products. Esters, such as amyl acetate, also have a very deteriorating effect on Neoprene compounds. While Neoprene is classed as a water-proofing material it will absorb some water if immersed in it for an extended period of time.

The Studebaker Corp. recently solved three interesting problems by the use of neoprene. In the first it was found necessary to obtain a steering tie rod seal which would retain the grease required for easy steering, and also retain its efficiency throughout the life of the car. A seal of neoprene was used, its resilience providing a tight seal against metal, and its resistance to deterioration by grease and oil assuring long service life. Secondly, it was found necessary to obtain a vibration absorbing connector for the oil pressure gage pipe which would not be destroyed by engine vibration and contact with oil and heat. A length of hose made of neoprene was adapted to this application because of its strength and elasticity, plus high resistance to the effects of oils, grease and engine heat. Thirdly, it was desired to build a flexible brake fluid conduit which would not be affected by the brake fluid used by Studebaker or by mineral oils. The neoprene hose tried out for this application was found satisfactory inasmuch as it would not swell excessively and thus obstruct the flow.

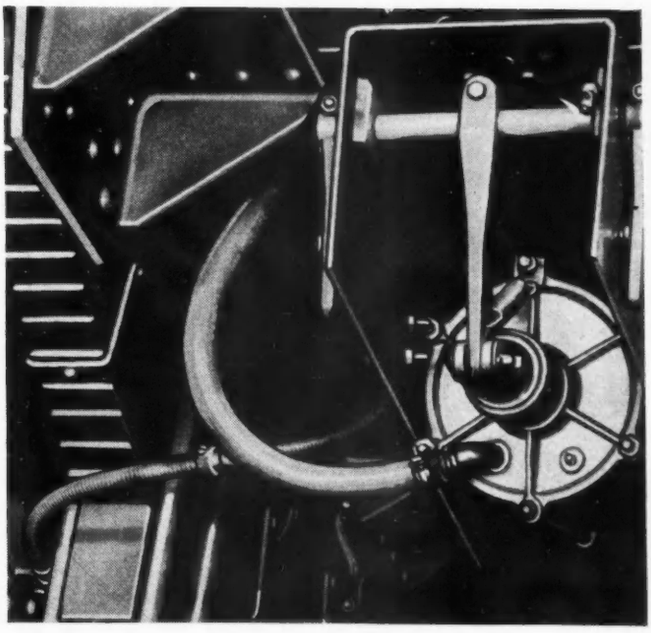
IF present plans are carried out successfully, all passenger automobiles manufactured in Germany will be equipped with synthetic rubber tires, according to information received by the U. S. Department of Commerce.

The first large-scale plant for producing Buna, the German synthetic product obtained from butadiene, an acetylene derivative, is located at Schokopau in central Germany, it is reported to have an annual capacity of 25,000 metric tons and came into full production during 1938. Construction of another plant at Huls Westphalie is under way.

Of Germany's current consumption of 100,000 tons of rubber annually, between 25 and 33 per cent will be supplied by domestic synthetic production. With the imposition of a heavy duty on imports of natural crude rubber and with the expanding production of carbide, the requisite basic raw material, the output of synthetic rubber is expected to increase steadily.

To eliminate spring squeak, the Packard Motor Car Co. on its 1939 models uses antimony-lead inserts in the ends of the three lower leaves. While the inserts do not require further lubrication, the metal will oxidize rapidly unless protected. Solution to the problem was found in protecting the inserts from oxidation by covering all surfaces except the friction surface with grease. A metal cap retainer was designed to keep the grease in position and a perfect seal between the metal cap and the lower leaf spring was effected by a neoprene seal. The neoprene in this application must resist the effect of the grease and stand up under the interleaf movement, i.e., compress or distort without breaking and still maintain a perfect seal.

With regard to aircraft applications of synthetic rubber-like materials, the Mareng fuel cell development is one of the newest. Glenn L. Martin engineers recently designed this cell which is made up of a neoprene impregnated fabric bag fitted into a metal compartment. The fabric fuel cells are purposely made slightly larger than the metal container into which they are placed in order that the fabric will never be stretched, will serve simply as a leakproof container with all stresses being taken by the metal container. In addition to being vibration proof the Mareng fuel cell has the added advantage of corrosion resistance inasmuch as the Neoprene will not be affected to a great extent by most petroleum hydrocarbons. Such tanks have been installed in aircraft in sizes ranging up to 185 gallons capacity. While



Thiokol vacuum hose used in Bendix vacuum power brakes

Oil filter lines of "Resistoflex" PVA flexible tubing installed on the Haver Oil Filter

the Mareng cell seems peculiarly suited for aircraft applications, other applications for it are being developed. An important factor favoring the use of such a cell for aircraft use, and not mentioned previously, is, of course, light weight.

The industrial possibilities for such materials as neoprene are virtually unlimited. Here are a few: air hose used where hot oil is injected into the air stream for tool lubrication; fuel oil hose; gasoline pump hose; oil suction and discharge hose; tank truck hose; propane and butane hose; flat transmission and vee belting; conveyor belts; sheet packing and gaskets; electrical cables; ignition wire; seals for gasoline storage tanks; gloves; airplane wing and hull caulking; engine mountings and vibration dampeners; and diaphragms; molded goods, such as grommets, sealing devices, bulbs, gaskets, cups, valve disks, coupling rubbers, and stoppers.

As previously mentioned, Perbunan, the German synthetic, is the same type of synthetic rubber-like material as Neoprene and has virtually the same applications. Components such as gaskets, water pump seals, hoses, and thermostat packings made from Perbunan are rendering very satisfactory service in the cooling systems of various automobiles. Perbunan is especially satisfactory for these uses because of its oil resistance, resistance to swelling by anti-freeze liquids, pronounced ability to withstand continued loading without appreciable cold flow and good all-around mechanical properties.

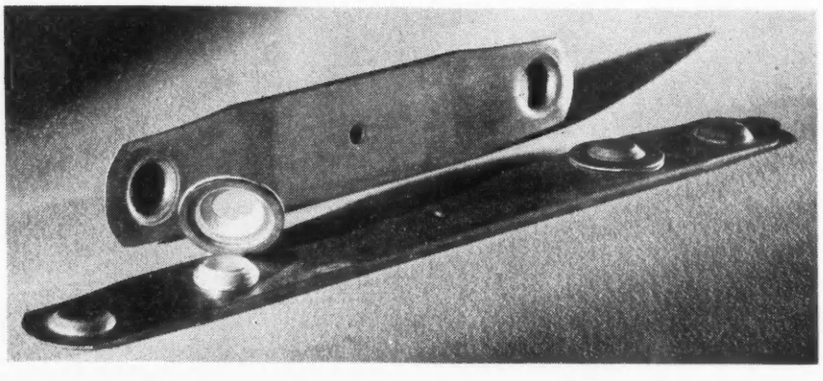
For shock absorber seals Perbunan is satisfactory because it exhibits the desired minimum swelling by the shock absorber liquids together with ability to withstand required hundreds of thousands of cycles operation without being worn by abrasion or distorted by cold flow.

Boots and bellows for enclosure of universal joints, vacuum gear shift mechanisms and the like work out particularly well if fabricated from Perbunan. Perbunan has the oil resistance required in such work and it has tensile strength, elongation, abrasion resistance, etc., comparable to natural rubber compounds. Perbunan is also used extensively in the automotive industry for windshield wiper blades.

This product when properly compounded and vulcanized produces finished articles which are swelled relatively little by lubricating oils, gasoline, vegetable oils, fats, and has remarkably high resistance to many organic solvents. Even when swelled to the limit by these materials, it retains a large measure of its original physical strength. High heat resistance is a valuable property of Perbunan. At temperatures above 200 deg. Fahr. slow hardening occurs, but no tackiness or resinification takes place.

For all practical purposes, the tensile strength, hardness and elasticity of Perbunan are comparable with natural rubber. The product lends itself best to compounding with carbon black as it does not develop maximum physical strength in the form of pure gum compounds or in the presence of the majority of white or inert fillers.

Perbunan is also high in resistance to the destructive influence of sunlight and natural weathering. It will withstand continued flexing before fatigue cracks will appear. Furthermore, this material ages much less rapidly than natural rubber. And, too, Perbunan is said to be at least as resistant to abrasion as natural rubber. In the presence of oil it has the advantage of retaining its abrasion resistance almost unimpaired. While Perbunan will take a small permanent set under load, the phenomenon of "creep" or continued flow is virtually absent. Finally, mention should be made of the fact that natural rubber and all its substitutes absorb a portion of the mechanical energy expended in deforming them. This energy is converted to heat which raises the temperature of the rubber as it is mechanically worked. The loss of energy in the form of heat developed internally with Perbunan is comparable to the best rubber compounds. Heat conductivity of Perbunan is about 20



Neoprene seals used in Packard anti-squeak spring device

per cent better than that of natural rubber; consequently the temperature rise in constantly flexed Perbunan compounds will be less than in a corresponding natural rubber compound.

In conclusion we wish to emphasize a point on which all manufacturers of synthetic rubber-like materials seem to concur. It is, simply, that the user should give careful consideration to the design of the part wherein the synthetic is to be employed. In cases where a certain synthetic will replace another material, especial attention should be given to this factor inasmuch as slight redesign of the part may mean infinitely better performance of both the material and the part for which it is used.

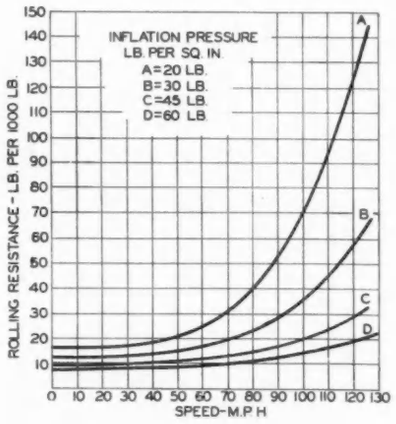
Calculating Needed Power

In making calculations of the power required for the propulsion of a vehicle at any given speed, it is generally assumed that the coefficient of rolling resistance is constant, regardless of speed, for a given vehicle and a given road surface. However, according to an article by Henri Petit in the *Journal of the French Society of Automobile Engineers* for December, this is far from being the case at really high speeds. M. Andreau, who assisted in developing Eyston's Thunderbolt from the aerodynamic standpoint, has analyzed a large number of test data furnished by the Continental Tire Co. and found that the rolling resistance varies with the inflation pressure and the car speed in accordance with the following equation—

$$f = \frac{1}{p^{0.64}} \left[110 + \frac{V^{2.5}}{925\ p^{1.44}} \right]$$

where f is the coefficient of rolling resistance in lb. per thousand lb.; p, the inflation pressure in lb. per sq. in., and V, the car speed in m.p.h. Coefficients of rolling resistance for four different inflation pressures and for speeds up to 125 m.p.h. have been plotted in the accompanying chart. It will be seen that whereas there is no great variation in the coefficient of rolling resistance within the range of normal touring speeds, the coefficient increases greatly at racing speeds, and especially with the lower inflation pressures.

There is, of course, still one other factor affecting the coefficient of rolling resistance, and that is the pliability of the tire walls. The data presumably refer to racing tires with thin, pliable walls.



THE CHILTON ROUND TABLE

In order to give readers of AUTOMOTIVE INDUSTRIES a clue to certain merchandising and service aspects of the automotive industry which are normally outside the scope of an industrial publication, we present herewith excerpts from the June issues of the four other magazines published by the Automotive Division of the Chilton Co.

From Motor World Wholesale

Judging by resolutions adopted by a number of regional jobber associations there is a growing feeling that application of the Wages and Hour Act, officially known as the Fair Labor Standards Act of 1938, to all employes of wholesale automotive organizations imposes higher cost which the average business is unable to absorb without impairment of working capital or cutting down on essential services.

From Automobile Trade Journal

"The used car business is big business," says Guy S. Garber. "Close to two billion dollars were spent for used cars in 1938, 1937 and 1936. In 1937, 10,000,000 used cars and trucks were purchased, while 60 per cent of all car owners never owned a new car.

"In a survey of several thousand people who had bought used cars recently, 75 per cent of them said they were influenced more by the dealer's responsibility than by the car itself."

From Commercial Car Journal

At least two entirely independent organizations are reported to have some new braking systems for heavy-duty service well under way. Some of the equipment has been on the road for many miles of actual operation. It's still too early to make a definite statement, but you can look for some important news before long.

From Motor Age

The annual "Carnival of Speed" at Bonneville Saltbed in northwestern Utah will definitely open Aug. 15. Reid A. Railton, the engineer who built Sir Malcolm Campbell's Bluebird racer and the Railton which John Cobb drove to a short-lived super-speed record last year, has made plans for Cobb's return. Railton said Cobb would bring the same car with which he set a record of 350.2 m.p.h. last September 15. Eyston has definitely cancelled his scheduled assault on his own record and has assured Salt Lake City authorities that he will make another attempt in 1940 if the "war scare" in Europe is alleviated by that time.

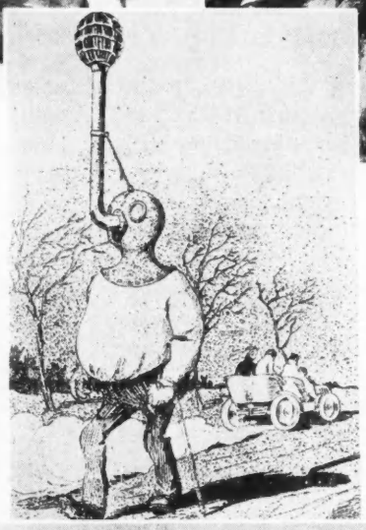
Thirty-five Years Bring Different Views

Around 1880 the inevitable race between the steam omnibus and several of the better horse-drawn vehicles was shown in the London press. The course was from Oxford Circus to Ealing, London

Illustrations from The Bettmann Archive

Below we see mother and family all dressed up for a twenty-mile an hour speed run in the fashion of 1909

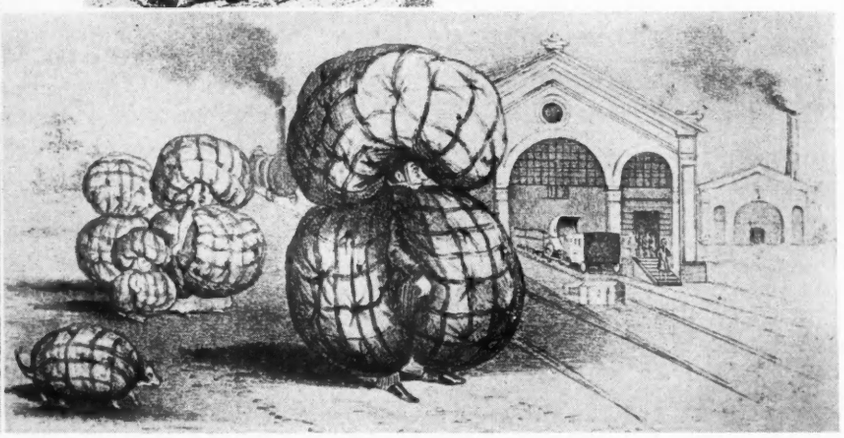
In the 19th century, the English cartoonist, Cruikshank satirized the March of Intellect with this steam-engine horse which was to fly from Paris to Leningrad (then St. Petersburg). In 1934 Martin Masson, an American, tried unsuccessfully to fly a steam powered airplane while an earlier attempt at flying was made in 1660 by Samuel Idler of Cannstatt



Ye Shades of periscopes and gas masks. This is only an artist's idea for escaping the perils of carbon monoxide gas when automobiles should become too numerous. It appeared in 1904

Below are shown some of the strange looking goggles and veils used to protect the riders of 1905 as pictured in the press of that date

The terrible railroads have taken jibes from the cartoonists as far back as 1840. This appeared as a warning to those about to take a trip on the new "invention of the Devil." The outfit was suggested as necessary protection while riding in the terrible "death traps"



NEWS OF THE INDUSTRY

FTC Urges "Unfair Practices" Be Abated in Report on Year's Study

Factory Supervision of Dealers Less Direct Since Start of Investigation, Says Commission

After spending more than a year investigating manufacturer-dealer relations in the automobile industry under the Withrow resolution, the Federal Trade Commission, claiming that inequities exist in the terms of dealer agreements and that treatment given "some dealers" by "certain manufacturers" calls for remedial action, has recommended to Congress that present "unfair practices" be abated so that dealers will have less restrictions placed upon the management of their affairs by manufacturers. The report observed, however, that methods of supervision employed were less direct in 1938 than in former years, that "pressure" by manufacturers has been less severe since the Withrow inquiry was ordered, and that some of the smaller manufacturers have cited changes in their 1939 contracts as indicating "a better deal for dealers."

Divided into sub-heads covering basis of manufacturer-dealer relations; pressure on dealers; itemized invoice needs for consumer protection; deception in charges for transportation of motor vehicles; profit on sales of accessories and replacement parts; financing company practices; growth and profits of large automobile manufacturers; selling demonstrator cars as new ones; and concentration of control and price competition, the report pointed out that active competition among manufacturers, although some companies have made "very large profits," gave to the public improved products, often at substantially reduced prices, and that consumer benefits from competition have probably been more substantial than in any other large industry studied by the Commission.

With respect to dealers, the FTC recommended the elimination of certain practices regarded as contrary to the best interests of consumers although in the case of local associations through which, the Commission said, dealers are bound by agreements to restrict competition in used car trading, it was noted that the regulation of such activities by local combinations becomes a matter to be handled by law enforcement agencies of the states and not by the Federal Government which lacks jurisdiction because of the intrastate character of the business.

"The larger automobile manufacturers, especially, exercise extensive supervision over many of their dealers," the report said in an explanation of

(*Turn to page* 736, *please*)

Acme Photo

Wilbur Shaw

. . . winner of the Memorial Day 500-mile classic at Indianapolis Speedway. Although his Italian-built Maserati qualified at 128.977 m.p.h., winning time was 115.035 m.p.h. due to precautionary slowing of the race for a time when a three-car crack up, fatal to last year's winner Floyd Roberts, made higher speeds dangerous until the track was cleared.

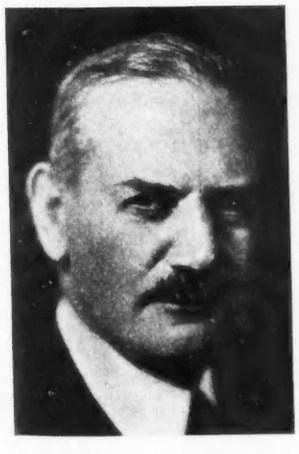
Reject Hupp Appeal

An appeal of the Hupp Motor Car Corp. for a reduction of $125,000 in its total delinquent tax bill of $275,000 was turned down by the City Council of Detroit on June 6. The reduction had been requested by S. L. Davis, Hupp president, who said that the reduction would enable the company to resume full production. The request was opposed on the grounds that it would establish a precedent which other delinquent tax payers might follow.

Harry B. Thompson

Harry B. Thompson, production manager of Clark Equipment Co., Buchanan, Mich., died at his home on June 6. Thompson had been with Clark Equipment Co. since 1926, and prior to that time had been assistant superintendent of the axle department of Buick.

Alfred Reeves Resigns from A.M.A. Post



Alfred Reeves (left) on June 9 resigned his position as vice-president and general manager of the Automobile Manufacturers Association; he will remain on the board as advisory vice-president. His successor is Pyke Johnson (right) vice-president, who for many years has been in charge of the AMA Washington office. (See news story, page 725)

Economy, Comfort, Safety Require Engineers' Attention, Says Knudsen

GM Head States Performance Leads Other Factors in Address to SAE Congress

In a talk before members of the Society of Automotive Engineers at the society's World Congress banquet in Detroit, W. S. Knudsen, president of General Motors Corp., paid tribute to the contributions of engineers in making the American automobile what it is today. After commenting upon the inefficiency of engineering methods in earlier days Mr. Knudsen said, "I feel you have every reason to be proud of the fact that even in the lowest price field, we can offer the public a 3000-lb. car with a cubic feet per ton mile rating of from 100 to 114 and a cubic feet per car mile rating from 175 to 200. This result is unequalled in any other country, and coupled with the fact that in this lowest price class, maintenance costs up to 25,000 miles are running very moderate, stands to the credit of the American automobile engineer. It should also be stressed that in other countries the superiority of the American product is recognized and sales are only limited by the artificial barriers set up against the importation of American cars."

In commenting upon factors requiring attention in present-day cars and probable future trends Mr. Knudsen went on to say, "It is probably correct to assume that generally, performance is out ahead of the field and that economy, comfort and safety are the factors requiring first attention. Good progress is being made along these lines. In economy the engineers have had the unquestionable improvement in fuels as a valuable assistant, but I think there are possibilities of still further progress in the improvement of carburetors that will handle fuel economically without being subject to too narrow adjustment variations—in other words, simple carburetion.

"The interior of our cars are the envy generally, of foreign manufacturers, but even here it seems to me that we could devise simpler means of accomplishing some of the functions first. Rubber cushions show some prom-

(*Turn to page 739, please*)

Agricultural Machinery April Exports Drop

The Commerce Department's Machinery Division reports that exports of agricultural machinery and implements during April, valued at $7,067,-114, were 17 per cent below the corresponding figure for April, 1938. Noting reduced shipments in all five major groups, the Department reports that the smallest decline, amounting to 7 per cent, took place in exports of tractors and parts which comprised 78 per cent of the total farm equipment trade during the month.

Hupp Loss

Net loss of the Hupp Motor Car Corp. for the three months ended March 31, 1939 has been reported by the company as $194,229.01. Sales of cars, parts and accessories for that period amounted to $173,218.84.

Aircraft Research

American manufacturers of airplanes, engines and propellers spent $44,000,000 in research and development work to improve the flying machine during the last five years, according to a survey of the industry made public by John H. Jouett, president of the Aeronautical Chamber of Commerce of America. That development work actually cost the industry 63 per cent more than its net profit for the five-year period.

The survey also revealed that commercial sales inside the United States aggregated $107,000,000, or 22.8 per cent of the total. Combined commercial domestic and export sales amounted to $250,000,-000, or 53.4 per cent of the total. In other words, more than half the industry's business has been outside the military and naval services of the United States, said Mr. Jouett.

PUBLICATIONS

The British Rubber Publicity Association has published in pamphlet form a reprint of an article, "**Rubber Tyred Farm Tractors,**" by Warren S. Lockwood, director, Crude Rubber Development Bureau, Washington. The article originally appeared in *The India Rubber World*, issue of March 1.*

A booklet by the Fostoria Pressed Steel Corp. describes 25 models of the Fostoria **fluorescent canopies.***

Bulletin R-1A of the Tomkins-Johnson Co. describes the application of its **Rivitor** in the aircraft and other industries.*

The **Electro-Matic air filter** recently introduced by the American Air Filter Co., Inc., is discussed in a new booklet.*

(*Turn to page 737, please*)

New Passenger Car Registrations

	APRIL 1939	MARCH 1939	APRIL 1938	FOUR MONTHS 1939	FOUR MONTHS 1938	Per Cent Change, 4 Months, 1939 over 1938	Per Cent of Total Four Months 1939	Per Cent of Total Four Months 1938	SIX MONTHS MODEL YEAR 1939	SIX MONTHS MODEL YEAR 1938	SIX MONTHS MODEL YEAR Per Cent Change
Chevrolet	63,363	58,383	47,782	206,761	156,927	+ 31.6	23.60	24.76	310,745	262,342	+ 18.7
Ford	45,535	42,698	37,389	156,547	136,871	+ 14.5	17.86	21.60	223,133	184,241	+ 21.0
Plymouth	37,470	34,910	27,317	126,296	82,719	+ 53.0	14.41	13.05	193,588	132,398	+ 46.5
Buick	21,042	19,320	16,512	69,121	52,102	+ 32.8	7.89	8.22	106,952	85,910	+ 24.5
Dodge	20,443	18,873	10,914	67,304	35,773	+ 88.0	7.68	5.65	95,373	61,384	+ 55.5
Pontiac	15,639	14,386	10,185	50,899	33,284	+ 53.0	5.81	5.25	76,639	56,171	+ 36.3
Oldsmobile	13,939	12,880	9,330	46,988	30,972	+ 51.8	5.36	4.89	72,391	51,121	+ 41.5
Chrysler	6,793	6,752	4,876	24,054	16,491	+ 45.9	2.74	2.60	34,851	28,854	+ 20.8
Mercury	5,983	5,245		19,276			2.20		26,111		
Nash	5,960	5,329	3,431	18,497	11,520	+ 60.3	2.11	1.82	24,101	18,866	+ 27.9
Studebaker	7,168	4,397	3,258	18,076	11,564	+ 56.0	2.06	1.82	27,544	19,265	+ 43.0
De Soto	5,385	5,114	3,613	17,641	12,509	+ 41.1	2.01	1.97	25,726	21,692	+ 18.5
Hudson	5,014	4,410	4,117	16,016	14,070	+ 14.3	1.83	2.22	25,423	23,339	+ 9.2
Packard	4,274	3,745	5,120	13,771	16,591	− 17.1	1.57	2.62	22,838	27,400	− 16.8
La Salle	2,325	1,917	1,666	7,344	4,758	+ 54.1	.84	.75	11,948	8,197	+ 46.0
Lincoln	1,820	1,718	1,658	6,855	6,276	+ 9.1	.78	.99	10,217	9,716	+ 5.2
Cadillac	1,270	1,099	1,075	4,569	3,727	+ 22.6	.52	.59	7,225	4,984	+ 45.0
Willys-Overland	1,102	1,023	1,185	3,850	4,848	− 20.5	.44	.77	5,772	9,301	− 38.0
Graham	441	402	396	1,470	1,789	− 17.8	.17	.28	2,184	3,149	− 30.7
Hupmobile	214	57	124	368	370	− 0.5	.04	.06	469	476	− 1.4
Miscellaneous	165	202	152	656	550	+ 19.2	.08	.09	955	996	− 4.0
Total	265,345	242,860	190,100	876,359	633,711	+ 38.6	100.00	100.00	1,304,185	1,009,802	+ 30.4
Chrysler Corp.	70,091	65,649	46,720	235,295	147,492	+ 49.1	26.85	23.27	349,538	244,328	+ 43.0
Ford Motor Co.	53,338	49,661	39,047	182,678	143,147	+ 27.8	20.84	22.59	259,461	193,957	+ 33.9
General Motors	117,578	107,985	86,550	385,682	281,770	+ 37.0	44.01	44.46	585,900	468,725	+ 25.0
All Others	24,338	19,565	17,783	72,704	61,302	+ 18.8	8.30	9.68	109,286	102,792	+ 6.8

Monoplane with Biplane Manoeuverability

Advanced design and structural features are said to give this new monoplane built by the Vought-Sikorsky Aircraft division of United Aircraft Corp. for the Navy, excellent landing characteristics heretofore available only in biplanes; this despite its relatively low power. The plane is powered with a nine cylinder Pratt & Whitney Wasp Junior engine rated at 400 hp. for take-off. Its chief function is conceived to be that of a seaplane operating from battleship catapults. Its structure incorporates a marked departure from previous practice in the use of spot welded aluminum alloy construction. A contract of $2,103,800 for these planes has been awarded.

Reeves Resigns As A.M.A. Head

Pyke Johnson to Succeed to Post

On the 25th anniversary of his election, directors at the annual meeting of the Automobile Manufacturers Association on June 9 granted the request of Alfred Reeves to be relieved of the responsibilities of that position. He will remain on the board as advisory vice-president and will continue to manage the national automobile shows. His successor will be Pyke Johnson, the present vice-president of the association, who for many years has been in charge of the Washington office.

Mr. Reeves was presented with a silver tea set and a framed testimonial expressing appreciation of his services and his continuance in the newly created office. He joined the National Automobile Chamber of Commerce, the former title of the association, in 1914 and represented the automobile industry at Washington during the world war.

Before entering the trade association field, he served as automobile editor of the *New York Evening Mail* and later as general sales manager of the U. S. Motor Co. He is a past president of the American Trade Association Executives. Mr. Reeves' first work upon joining the NACC was to carry through the now famous cross-licensing patents agreement for a free exchange of patents between the manufacturers. Originally this agreement was signed by 76 of 80 members. In 1922, 120 manufacturers were parties to the arrangement, which is still in effect, although in changed form.

The new vice-president and general manager, Pyke Johnson, for many years head of the AMA Washington office, is widely known in trade association and automobile circles. He was a former editor in Denver and has held many official positions in highway organizations here and abroad, several by presidential appointment. He is executive secretary of the Highway Education Board and a former president of the American Trade Association Executives.

Tire Makers Revise Volume Bonus Scales

As predicted in these columns (AUTOMOTIVE INDUSTRIES issue of May 15, page 626), tire manufacturers have drastically revised their discount and bonus-for-volume schedules, to conform to the Federal Trade Commission's ruling in its recent order against the United States Rubber Co., directing that the practice of granting cumulative bonuses to dealers dependent upon their respective volumes over specified periods be discontinued.

Industry volume bonuses have ranged from 1 per cent on $1,000 worth of tires purchased over the period of a year, up to 15 per cent on $50,000. These volume bonuses were in addition to trade discounts.

New schedules which drastically shave the sliding bonus scale and cut the maximum from 15 per cent to 2½ per cent have been announced by several manufacturers—all programs, it is understood, retroactive and effective as of May 1. Under some of the new schedules, the bonus starts at 1 per cent for $1,000 and goes to 2½ per cent for $50,000 or more. Discounts are increased to compensate to some extent for the reduction in bonuses for volume.

The move in the main narrows the buying price margin between large and small dealers and benefits the bulk of dealers in the "small dealer" class.

Estimated Dealer Stocks of New Passenger Cars

1938	January	February	March	April	May	June
Production—U. S. Domestic Market†	130,273	119,896	153,316	160,028	140,239	123,333
Retail Sales—U. S.‡	126,442	120,348	188,325	193,392	187,306	155,811
Change in Inventory	+3,831	−452	−35,009	−33,364	−47,067	−32,478
Inventory, first of month	408,157	411,988	411,536	376,527	343,163	296,096
1938 (continued)	**July**	**August**	**September**	**October**	**November**	**December**
Production—U. S. Domestic Market†	96,975	53,955	60,177	171,371	295,366	305,900
Retail Sales—U. S.‡	153,426	123,711	90,629	134,984	241,009	241,623
Change in Inventory	−56,451	−69,756	−30,452	+36,387	+54,357	+64,277
Inventory, first of month	263,618	207,167	137,411	106,959	143,346	197,703
1939	**January**	**February**	**March**	**April**	**May**	**June**
Production—U. S. Domestic Market†	263,225	223,745	279,148	257,058	.....	.....
Retail Sales—U. S.‡	180,651	165,841	276,301	265,756	.....	.....
Change in Inventory	+82,574	+57,904	+2,847	−8,698	.....	.....
Inventory, first of month	251,980	344,554	402,458	405,305	396,607	.....

†—U. S. Census Bureau. ‡—Automobile Manufacturers Association.

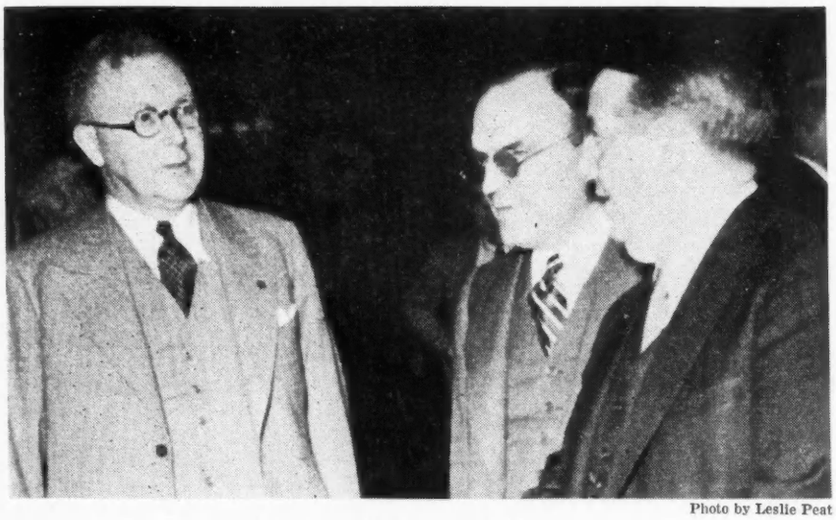


Photo by Leslie Peat

Sharing Responsibilities

William J. Davidson, president, Ralph R. Teetor, past-president and chairman of the meetings committee, and John A. C. Warner, secretary and general manager of the Society of Automotive Engineers, shown as they talked together following one of the New York sessions of the 1939 World Automotive Engineering Congress of the society. The major share of the responsibility of the Congress rested upon these three men.

Settlement of Briggs and Minor Strikes Ends Production Upset

Majority of Martin UAW Faction Approves Affiliation with AFL

The worst disruption of automotive production facilities in more than a year was brought to an end on June 7 by the settlement of one major strike and several minor ones. It was estimated that more than 150,000 workers, directly or indirectly affected by the strikes, returned to their duties on June 8.

Most important settlement was that of the strike in all plants of the Briggs Mfg. Co. which had lasted through almost three productive weeks and which had closed all Chrysler plants, the Lincoln plant of the Ford Motor Co., made transportation workers idle as well as parts workers in plants supplying Briggs and Chrysler. The strike was settled through an agreement for a new contract for Briggs workers which did not include a union shop clause upon which the UAW-CIO had originally insisted, but the agreement does in effect give the UAW-CIO bargaining rights for its members until the status of the union is determined by an NLRB hearing now being conducted to decide whether the UAW-CIO or the UAW-AFL is representative of Briggs employes. The company had flatly refused to consider the union shop clause. Another important clause in the new contract provides that no strikes will be called by the union until every means provided by regular grievance procedure has been exhausted.

Also settled on the same day were strikes at the Graham-Paige Motor Corp. and the Brown-McClaren Mfg. Co. The Graham strike resulted from a dispute between rival factions in the UAW as to which was representative of employes and was settled by agreement to hold an election under supervision of the U. S. Dept. of Labor. The Brown-McClaren strike reached an end with the company's agreement to renew its former contract with the UAW-CIO and to halt moving of machinery to its Hamburg, Mich., plant for three months pending a survey by James F. Dewey, Federal Labor Conciliator.

Other important labor developments saw the reissuance of the original AFL charter held by the UAW to the Homer Martin faction of the Union following a referendum vote in which the membership approved affiliation with the AFL by a large majority. In announcing approval of the move to rejoin the AFL, Martin made broad claims as to the jurisdiction of his union in automotive, aircraft and affiliated industries but the exact scope of his jurisdiction is still subject to considerable clarification. Leaders of two AFL unions in the automotive industry, the Pattern Makers League of North America and the International Association of Machinists, have indicated they will refuse to surrender jurisdiction to Martin. Meanwhile, proceedings were still under way in the Wayne County Circuit Court to determine whether the AFL or the CIO branch of the UAW is entitled to the union's name, records and treasury. At the same time the NLRB was conducting hearings on petition of the CIO faction asking its recognition as sole bargainer for Chrysler employes, a hearing which the Martin faction is opposing on the grounds that only the courts can settle this question. In settlement of the Briggs strike the Martin faction was ignored.

Australia's Hope For Industry Wanes

Car Builders' Bounty Finds No "Takers"

Australia's hope for a domestic automobile industry has remained just that. An indefinite tariff policy has previously been reported as a stumbling block to that country's desire for its own industry (See AUTOMOTIVE INDUSTRIES issue of Feb. 4, 1939, p. 118), despite a bounty plan inaugurated in 1936 to induce manufacturers to establish plants.

By the end of April, it is reported, only one proposal for the manufacture of complete motor cars in Australia had been submitted to the Commonwealth Government—and that was not acceptable. The offer was made by a small South Australian firm which, it was officially considered, had not the equipment or resources to carry out the organization of a new industry.

A chassis duty, which was imposed in 1936 to provide money for the payment of bounties on locally-produced cars, has now accumulated to nearly $5,000,000. The only allocation made from it, so far, has been a bounty on car radiators which will absorb about $30,000 a year for two years. The Ford Motor Co. of Australia offered to manufacture wheel parts and frames on a large scale with assistance from the bounty funds, and proposals were expected to be received from General Motors-Holdens.

The response to the Government's invitation for the submission of proposals for car manufacture, an observer stated, indicates that there is no possibility of the fund being used in the purpose for which it was raised. Strong moves were expected to be made to have the chassis tax abolished.

Continental Motors Reports Profits

Report of Continental Motors Corp. for second quarter of its fiscal year, (the three months ended April 30, 1939) shows a net profit of $15,430 after all charges, compared with net loss of $141,664 in the preceding quarter and a net loss of $29,693 in corresponding quarter last year. For the six months ended April 30, net loss was $126,234 as against net loss of $190,421 in first half of the previous fiscal year.

Return to profitable operations in the second quarter was the result of sub-

stantially increased sales and material improvement in operating economies. Second quarter sales were up 49 per cent over the preceding three months, and for the six months of the current year, sales show a gain of 21.9 per cent over the first half previous fiscal year. Company went into the third quarter with unfilled orders totaling approximately $2,800,000.

Waukesha Earnings

After reserve for normal state and federal income taxes, but without provision for undistributed profits tax, the earnings as of April 30, 1938, at the close of the third quarter of the fiscal year of Waukesha Motor Corp. were $192,672.38. The regular quarterly dividend of 25 cents per share was declared by the company, payable July 1, to stockholders on record as of June 15.

Retail Financing Up 44.5 P.C. in April

The dollar volume of retail financing of new passenger automobiles was 44.5 per cent higher in April than during the same month of 1938, and 34.8 per cent off from April 1937, according to preliminary estimates by the Department of Commerce. As compared with March 1939, there was an increase of 8.8 per cent.

40 YEARS AGO

There is one feature of the motor carriage problem which from a mechanical standpoint seems to be lagging behind, and that is the steering mechanism. From the time the first vehicle was seen on the road to the present day, the same bell cranks, connecting rods, uprights and handle-bars are in evidence. Of course, some of the newer carriages have some cushion springs or shock receivers added to the steering, but those additions merely complicate parts without doing any material good.

It is strange that power is not made to do the work, especially where a constant pressure is used; for instance, the principle of a reversing gear on a locomotive could be used.

In the electrical field several makers are contemplating an improvement, by which a series of magnetic contact blocks will be operated by switch or rheostat, power being taken from storage battery.

On a gasolene or vapor motor the solution would not be quite so simple. By complicating the parts somewhat an air compressor could probably be devised, connected by eccentric from one of the axles, but whether such an arrangement could be made substantial and still light enough is a question.

From *The Horseless Age*, June, 1899.

Automotive News from the Orient; Monopolization of Car Production

Legislation in Manchukuo Will Mean Exclusion of Private Motor Interests

The Government of Manchukuo will shortly promulgate the Manchuria Automobile Manufacturing Company Act when the bill is approved by the State Council. The semi-governmental corporation which will be established under the provisions of the bill will be capitalized at about $27,250,000, with the whole amount to be invested by the Manchuria Heavy Industry Development Corp., the continental sister enterprise of the Japanese Nissan concern. The new company will manufacture and sell motorcars and will have its head office at Hsinking.

The Manchukuo Government has also decided to revise the Tungho Automobile Manufacturing Company Act so as to have the assembling and selling of motorcars monopolized by the Tungho Motorcar Manufacturing Co. Its capital will be increased to about $8,000,000.

The contents of these draft bills clearly indicate the direction in which the motorcar industry of Manchukuo will develop in the future. There will be not only State assistance in the upbuilding of the industry, but the State is to monopolize the entire business to the exclusion of private motor interests who might like to take a chance in this, on the whole, not unpromising market.

It now appears that American automobile firms were never as keenly interested in Manchukuo's motor schemes as Mr. Yoshisuke Aikawa, president of the heavy-industrial corporation, repeatedly claimed they were. Only recently officials of the company asserted that Mr. Asahara, its managing director, had sent very encouraging reports from the United States, where he came several months ago to mobilize American motor capital. It was added that the company's representative stationed in Germany had sent similarly favorable reports about the prospects of German cooperation in the scheme.

By the recent monopoly moves Manchukuo has all but slammed shut the door to foreign investors. Mr. Aikawa still holds on to the belief that foreign capital will find its way into Manchukuo, if not in the shape of subsidiaries or branch plants of foreign automobile firms, it will be provided in return for shares or bonds in his semi-official corporation.

But few qualified business people here believe that American automobile firms will depart from their traditional overseas investment policy. Though in England and Germany they have shared investments with local industrialists, they have insisted on retaining actual control, while absolute control has been retained in branch plants set up in countries which are less advanced industrially. It is also recalled that both Ford and GM have declined to surrender control in their Japanese branch plants to native interests, although they might have improved their business status by doing so.

The chances of obtaining German machinery, patents and engineers in return for a share minority in Manchukuo automobile plants do not seem to be too bright, either. Germany is not an important manufacturer of automotive machine tools, and many tools that are made in Germany for local installation cannot be exported owing to patent agreements. In spite of Japanese trade agreements which definitely favor German and Italian machinery, Japanese automobile plants have been tooled up almost exclusively with American standard equipment, the only known exception being a set of Italian-made Fiat borers and millers for the Tokyo Automobile Industry Co.

Moreover, Germany's commercial activities in Manchukuo point to anything but the desire to become tied down by long-term investments in kind.

(*Turn to page* 733, *please*)

Charcoal

Charcoal "filling stations" have made their debut in Tokyo. With strict government control on gasoline in force, the number of cars being equipped with charcoal burning engines has made necessary the construction of these new stations to handle the bulky fuel.

Tentative Hearing Date Set on GM Anti-Trust Case for Oct. 9

Ourselves and Government—A Check List Of Federal Action Corrected to June 8

DEPARTMENT OF JUSTICE

ANTI-TRUST CASE. The Federal Government's anti-trust case against General Motors Corp. will be tried in the U. S. District Court for Northern Indiana in South Bend, Oct. 9, Judge Walter C. Lindley, Danville, Ill., special judge in the case instead of Judge Thomas W. Slick, has decided tentatively. Judge Lindley has taken under advisement a motion of the General Motors Corp. counsel for a bill of particulars in the case. A petition of the corporation to set aside Judge Slick's order overruling a demurrer against the Federal Government's indictment also was taken under advisement.

In brief review, to refresh readers' memories, the Federal Grand Jury in South Bend, Ind., returned indictments early last year against approximately 60 executives of General Motors, Ford and Chrysler; Commercial Credit Co., Universal Credit Co. and General Motors Acceptance Corp. charging conspiracy to violate Sherman Anti-Trust Acts. A similar case was dismissed in Milwaukee by Federal Judge Geiger, Dec. 17, 1937. In November, 1938, Federal Judge Slick of the U. S. District Court at South Bend gave provisional approval to Chrysler and Ford consent decrees (AUTOMOTIVE INDUSTRIES, Nov. 19, p. 663). Final settlement hinged on the outcome of the GM case now tentatively scheduled for Oct. 9.

FEDERAL TRADE COMMISSION

MANUFACTURER-DEALER INVESTIGATION. Report of the investigating committee made public, see news story on page 723 of this issue.

SIX PER CENT CASE. Final arguments on Ford case were presented May 4. Next move will be either an order or dismissal by the Commission. Similar case involving the FTC complaint of false and misleading representations as to interest charged automobile purchasers under deferred payment plans is pending against General Motors.

VS. UNITED STATES RUBBER CO. and its subsidiary U. S. Tire Dealers Corp. (No new developments.)

FAIR TRADE PRACTICE RULES. (No new developments.)

F.O.B. PRICE CASE. (No new developments.)

GENERAL MOTORS EXCLUSIVE DEALER CASE. Hearings were resumed in Detroit, May 25.

INTERSTATE COMMERCE COMMISSION

RATE INVESTIGATION. The general investigation of automobile freight rates of railroads, water lines and highway carriers, has been postponed by the ICC to Sept. 19. The hearing had previously been scheduled by the Commission for June 13.

AMERICAN TRUCKING ASSOCIATIONS, INC., and a number of individual motor carrier operators have filed a complaint in the U. S. District Court for the District of Columbia asking the Court to issue a mandatory injunction compelling the ICC to assume jurisdiction over hours of work and qualifications of all motor carrier employes. To this end the complaint asked the Court to set aside an order of the ICC which limited the Commission's jurisdiction to establishing maximum hours of employes for truck drivers only.

DEPARTMENT OF LABOR

STEEL WAGE CASE. (No new developments.)

Hudson May Sales

Retail sales of Hudson cars in the United States for the first four weeks of May gained 34 per cent over the same period a year ago, it was announced by George H. Pratt, general sales manager. Hudson's average daily rate of sales in 52 cities during May was 8 per cent higher than in April, against an industry gain of only 2 per cent, Pratt disclosed.

First Million

Milestone in the annals of the British motor industry was May 22. On that day the 1,000,000th Morris from Viscount Nuffield's factory at Cowley was placed on the road. This is the first British factory to have built 1,000,000 cars.

W. R. Morris, interested in combustion engines while owner of a bicycle shop, built the Morris motorcycle from 1903 to 1910 when he turned to the manufacture of automobiles.

German Decree Limits Buses Using Gasoline

A report from the American Commercial Attache at Berlin, Germany, indicates that, according to a recent decree, buses equipped with gas-engines (i. e., other than Diesel) and accommodating more than 16 passengers, must use only gas-producing fuels, especially liquefied gases. An exception is granted in the case of buses serving communities of less than 20,000 inhabitants where there is no suitable filling station within 10 kilometers. Measures are to be taken, it was said, to supply such fuels or compressed gases.

The decree becomes effective on Oct. 1 for the old Reich and on April 1, 1940, for Austria. The purpose ascribed to the decree is the necessity for the reduction in the stocks of gases accumulated as by-products from the increased production of synthetic gasoline. It will also have the obvious effect of reducing gasoline consumption.

AUTOMOTIVE INDUSTRIES

Summary of Automotive Production Activity

BUSES Slight gains in production continue to be reported. One large producer says it is now operating at about 54 per cent of capacity. Same producer states good position is due to number of small orders, as individual orders are not large.

TRUCKS Production and retail sales holding up well with majority of producers expecting good business to hold up into the fall. One large producer states second quarter is not expected to be quite so good as first. Another manufacturer reports orders are holding up particularly well on heavy duty equipment.

TRACTORS Little change noted in production activity. Retail sales are reported ahead of last year and, thus far, show no indication of taking again the sudden decline which occurred about this time last year. One large producer states indications are that business will continue good the rest of the year.

AUTOMOBILES Early June production rates higher than anticipated despite assemblies at several plants tied up by strikes. Continuance of present retail sales strength may result in June output of close to 300,000 cars and trucks.

MARINE ENGINES Little change in production activity since last report. Output appears to be holding up well.

AIRCRAFT ENGINES Schedules continue to be stepped up. Some producers are talking of plant expansion, although at present are trying to increase output using existing facilities.

This summary is based on confidential information of current actual production rates from leading producers in each field covered. Staff members in Detroit, Chicago, New York and Philadelphia collect the basic information in all cases from official factory sources.

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MEN . . . . . .

Richard Rimbach has been appointed technical advisor to R. C. Emos, president of Standard Steel Spring Co. He will work on the development and promotion of a new process for coating steel with a pore-free metallic coat.

C. F. Goldcamp has been appointed manager of sales, cold finished department of the Jones & Laughlin Steel Corp., to succeed the late J. D. Allen.

Appointment of **William Blackie** as controller of the Caterpillar Tractor Co. has been announced by company officials. Mr. Blackie has been a supervising manager with the Chicago office of Messrs. Price, Waterhouse & Co., accounting firm.

W. M. Packer has been named vice president of distribution of the Packard Motor Car Co. Since January, 1936, Mr. Packer has been Packard's general sales manager.

Ward H. Barnett has been appointed to the newly created post of director of commercial car sales for the Plymouth division of Chrysler Corp. For the past three years Mr. Barnett has been director of commercial car sales at the De Soto Motor Corp.

Announcement has been made of the appointment of **W. Robert Timken** as assistant to the president of the Timken Roller Bearing Co.

By vote of the stockholders of the Hudson Motor Car Co., **Guido G. Behn** returns as a member of the board of directors to the organization he served for nearly 20 years as chief engineer.

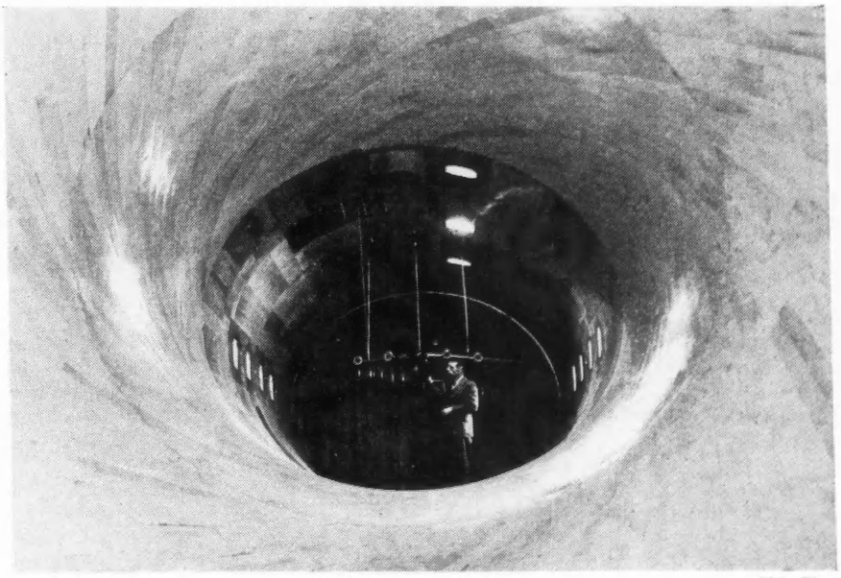
Succeeding C. P. Simpson, who resigned recently to take over an important dealership in Texas, **Don U. Bathrick** has been appointed general sales manager of Pontiac Motor division, General Motors Corp.

Frank Elwell, veteran works engineer of the Buick division of General Motors, has been named president of the Flint Industrial Executives club for next year. Other officers are **L. W. Johnson**, Chevrolet parts and service manager, vice president; **Albert J. Proctor**, A. C. Spark Plug Company's plant superintendent, treasurer; and **Herbert Mohan**, Fisher Body superintendent, secretary.

T. W. Moss, director of truck sales of Dodge division, Chrysler Corp., has been appointed to membership on the Motor Truck Committee of the Automobile Manufacturers Association.

V. L. Smithers, of Akron, has been appointed commissioner of the National

(*Turn to page 734, please*)



Globe Photo

Outblows Hurricanes

View taken inside the Fairey wind-tunnel in England. Said to be the largest such tunnel in the world, model planes are tested in winds of up to 145 m.p.h.—faster than any hurricane on record. The model shown under test is of a new airliner, said to be capable of 275 m.p.h., which is now being built for the British Air Force.

Upturn in Steel Operations Due Solely to Automotive Demands

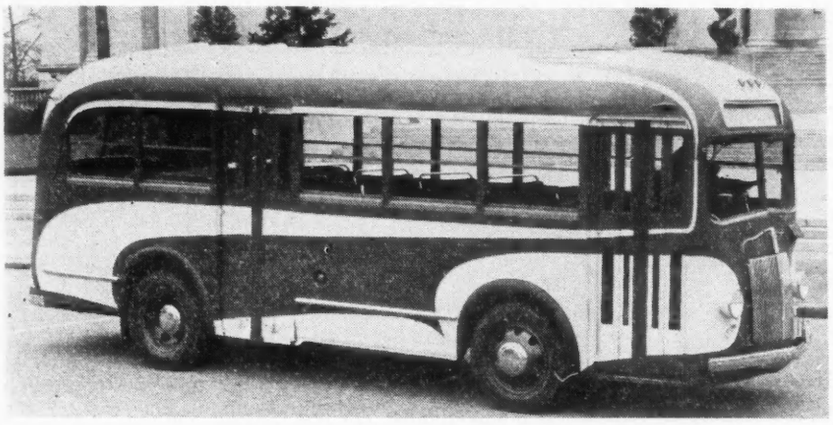
Business from Car Manufacturers Helping Mills Over "Rough Spots"; Future Uncertain

Steel producers are striving with main and might to pry loose from automobile manufacturers specifications in sufficient volume to permit rolling mills to operate at a more satisfactory rate. Some steel companies, so market gossip has it, have set the end of June as deadline for the furnishing of specifications and shipping instructions, and Sept. 30, the end of the third quarter, as that for making deliveries of sheets and strip steel bought at recent concession prices. There is every indication that the large automobile manufacturers will specify as promptly as possible and accelerate to the best of their ability the flow of steel into 1940 model assemblies. The American Iron & Steel Institute's estimate of the rate of employed ingot capacity reflects chiefly the increase in primary operations to provide the necessary semi-finished material for later rolling of body and fender stock, although a mild improvement in rolling activities is already noted in several of the steel-making districts. Slightly better buying of hot rolled carbon and alloy steel bars is also noted. Some last-minute buying of mechanical tubing for final 1939 model assemblies is reported. Wire manufacturers report inquiry from the automotive industry as lagging, and bolt and nut manufacturers look for little pick-up in demand until later in the summer.

All sorts of predictions are made with reference to how the steel industry will fare later in the year. The upturn in the last few weeks has been almost solely due to improved demand from automobile manufacturers. The Fourth of July holiday is likely to bring shut-downs of varying duration, thus throwing the steel industry's statistical picture slightly out of focus. Whether operations will backslide to around 45 per cent of capacity or climb to around 55 is anybody's guess. Certain it is that business from the automobile manufacturers is helping the steel producers over the roughest spots, so that they are pinning their hopes chiefly on further support from that quarter.

With the supply of coal again normal, pig iron producers have resumed routine operations. Inquiries from automotive foundries are on the uptrend.

It is interesting to note that steel industry analysts ascribe the disappointing showing of electric furnace production, which last year amounted to little more than 500,000 tons, or a paltry 1.78 per cent of the total steel output, to the fact that a number of automotive steels, formerly made in the electric furnace, are now being made in open-hearth furnaces at a saving in cost.



Lightweight White Coach

Two new bus models, alike in all respects except power plant, have been announced by the White Motor Co. Built to sell in the low price class, the new models embrace five body types. Engines are six cylinder, L-head, mounted under the floor midway between front and rear axles.

April Car Exports Below March, Over '38

Passenger car exports during April, as indicated below, totaled 16,119 units, valued at $10,036,050, against 17,874 units, valued at $11,165,435, in March. According to the Department of Commerce leading countries of destination during the month were Union of South Africa, Canada, Sweden, Australia, Belgium, Argentina, Brazil and Mexico in that order.

Exports of aeronautic products during April amounted to $7,456,519, a decline of three per cent from March, but an increase of six per cent over April 1938. During the first four months of 1939 exports of aircraft increased 59 per cent in number and 44 per cent in value as compared with 1938. Engines decreased two units in number but the value increased 26 per cent.

	APRIL 1939		APRIL 1938		FOUR MONTHS ENDED APRIL 1939		1938	
	No.	Value	No.	Value	No.	Value	No.	Value
EXPORTS								
Automobiles, parts and accessories		$ 24,921,194		$ 26,369,817		$ 109,116,220		$ 117,824,103
PASSENGER CARS								
Passenger cars and chassis	16,119	10,036,050	15,564	9,781,032	65,008	40,017,711	70,971	44,484,088
Low price range $850 inclusive	14,568	8,380,706	13,533	7,578,535	57,789	32,343,744	61,765	34,466,181
Medium price range over $850 to $1,200	1,307	1,254,065	1,743	1,710,124	6,183	5,920,773	7,886	7,797,858
$1,200 to $2,000	208	301,743	233	344,763	854	1,281,898	1,045	1,543,337
Over $2,000	36	99,536	55	147,610	182	471,296	274	676,712
COMMERCIAL VEHICLES								
Motor trucks, buses and chassis (total)	10,845	6,967,365	9,905	7,076,733	42,839	26,681,577	53,448	33,322,428
Under one ton	2,005	846,915	1,614	739,527	6,660	2,830,715	7,398	3,099,689
One and up to 1½ tons	6,446	3,679,278	5,881	3,215,999	29,057	15,727,463	37,217	20,044,242
Over 1½ tons to 2½ tons	1,959	1,658,908	1,178	989,941	5,045	4,341,214	5,519	4,455,164
Over 2½ tons	382	717,334	1,008	1,932,801	1,731	3,485,415	2,536	5,154,724
Bus chassis	53	64,930	224	198,505	346	296,770	778	568,609
PARTS, ETC.								
Parts except engines and tires								
Automobile unit assemblies		3,217,083		4,789,670		15,297,591		21,086,262
Automobile parts for replacement (n.e.s.)		3,451,870		3,273,258		12,694,588		12,706,913
Other automobile accessories (n.e.s.)		378,891		282,978		1,250,663		1,142,429
Automobile service appliances		624,116		612,783		2,059,381		2,092,957
Airplanes, seaplanes and other aircraft	109	4,518,952	72	4,220,514	427	17,178,750	231	11,261,552
Parts of airplanes, except engines and tires		1,354,694		2,215,862		4,929,296		7,688,624
INTERNAL COMBUSTION ENGINES Stationary and Portable								
Diesel and semi-Diesel	36	105,278	69	201,236	135	413,733	191	877,276
Other stationary and portable								
Not over 10 hp.	839	59,950	904	57,380	4,322	247,952	3,892	269,314
Over 10 hp.	214	117,875	436	214,360	497	365,543	1,193	489,963
Engines for:								
Motor trucks and buses	1,971	246,756	2,945	273,779	9,808	1,158,519	12,611	1,380,098
Passenger cars	1,615	146,646	4,659	372,659	10,823	1,030,747	23,256	1,876,287
Aircraft	155	1,043,723	124	573,367	416	2,782,957	428	2,307,859
Accessories and parts (carburetors)		283,585		278,632		848,508		1,007,846
IMPORTS								
Automobiles (dutiable)	36	26,293	45	28,587	165	122,398	232	137,961

Boeing Completes Production Line

The Boeing Aircraft Co. has announced the completion of a factory rearrangement program that provides a full-fledged production line of four-engine Army Flying Fortresses, highly similar to the assembly line system used in automobile factories. Officials said a carefully worked out program of mass production methods in the manufacture of the bombers on order for the U. S. Army Air Corps is now in full swing, and the first plane of the new fleet will be ready for flight shortly.

Virtually all of the 175,000 square feet of floor area in the company's Plant No. 2 adjoining Boeing Field has been turned over to the new assembly line for speedy production of the Flying Fortresses. To make possible an uninterrupted line of the bombers in various stages of construction, all the Boeing Stratoliners were removed from the main assembly floor in the plant, and final assembly work on these planes was transferred to a new assembly area outside the building.

Under the new system that has been gradually developed and placed in operation, special production lines of wings and sub-assemblies lead up to the main assembly line, where the planes progress successively through eight stages of assembly. Each time a completed airplane is released, every other plane in the line moves up to the position formerly held by the plane immediately ahead of it.

First the unadorned airplane fuselages are moved up from their construction jigs to position No. 1 on the assembly line. At the next position workmen begin installing flight controls. In the third position a crew installs the inner sections of the wings. Then the plane moves on to the next crew ahead, which installs landing gear, engines, and tail surfaces. The crew of the fifth position installs the outer wing sections and begins the installation of electrical systems and gun turrets. Fuel and oil tanks and such items as radio and automatic pilot are added at position No. 6. At the seventh station the plane gets its interior furnishings and equipment, and at the eighth all the final installations are made preparatory to releasing the airplane for power plant tests and flight.

Rim Inspections and Approvals Increase

Rims inspected and approved by the National Tire & Rim Association in April, 1939, numbered 1,348,335. This was compared with 970,545 for April, 1938, an increase of nearly 40 per cent. For the first four months of 1939 inspections numbering 6,235,218 were more than 120 per cent over the same period in 1938.

Carl H. Vaupel

. . . . newly appointed sales manager of Diesel Equipment Corp., Chicago. Well known in the Diesel industry, Mr. Vaupel served 13 years with Fairbanks, Morse & Co. in various capacities in the research and engineering departments. For the past two years he has been sales engineer for the Northern Pump Co.

Wholesale Financing

Wholesale financing of cars, as compared with the wholesale value of domestic sales of cars and trucks, rose from 23.5 per cent in 1929 to 74.8 per cent in 1938, according to M. V. Ayers, secretary and analyst of the National Association of Sales Finance Companies. Since 1935, said Mr. Ayres, the ratio seems to have settled down to an almost constant figure, being more than 73 per cent and less than 75 per cent in each of the past four years.

Nash Survey Reveals High Dealer Profits

A national cross-section survey of Nash dealers indicates that 80 per cent of them operated profitably during the first quarter and realized net returns believed to be the highest in the automobile industry, it was reported by W. A. Blees, general sales manager, Nash Motors division, Nash-Kelvinator Corp. The survey, completed by the business management department of Nash Motors, impartially covered financial statements of Nash dealers in every section of the United States, it was said, and shows that eight out of every 10 of the company's dealers reporting are averaging $83 net profit per new car unit sold at retail, Blees said.

"This figure represents an average margin of 4.5 per cent net profit on total volume of sales," he said, "probably the greatest profit margin being earned by any dealer organization in America today."

The average of all dealers, including the two-tenths who did not operate in the black during the period, was $46 per new car sold at retail, he said, pointing out that this figure far surpasses the U. S. dealer average shown in other surveys.

By way of comparison, Blees called attention to a recent national survey of dealers selling all makes of cars (AUTOMOTIVE INDUSTRIES, April 15, 1939, p. 479), which revealed that the average automobile dealer during 1938 made about 0.21 per cent net profit on total sales, or about $4.24 per car. This same survey, published in April, 1939, stated that during 1937—the second best year in the history of the industry—the average dealer realized about 1.35 per cent net profit on total sales.

Continental Acquires Howell Engineering Co.

The Industrial Equipment division of the Continental Roll & Steel Foundry Co. has announced the acquisition of the Howell Engineering Co., St. Charles, Ill., manufacturers of automatic polishing and buffing equipment made under the B. F. Bower patents and patents pending. The engineering, service and sales staffs have also been absorbed.

Complete production of these products, which will henceforth carry the name "Continental," will be at the company's East Chicago plant; the Coraopolis, Pa., and Wheeling, W. Va., plants concentrating on the company's products for the steel and other industries, and steel castings in general.

H. W. Faint, long associated with metal polishing and buffing equipment, will head the sales department.

Monthly Motor Vehicle Production (U. S. and Canada)

	PASSENGER CARS		TRUCKS		TOTAL MOTOR VEHICLES	
	1939	1938	1939	1938	1939	1938
January	291,444	168,890	62,502	58,262	353,946	227,152
February	250,897	151,133	61,244	51,454	312,141	202,587
March	312,392	186,341	77,097	52,256	389,489	238,597
April	286,200	190,111	68,063	48,018	354,263	238,129
May	.....	168,599	.....	41,575	.....	210,174
June	.....	147,545	.....	41,857	.....	189,402
July	.....	112,114	.....	38,336	.....	150,450
August	.....	61,687	.....	35,259	.....	96,946
September	.....	69,449	.....	20,174	.....	89,623
October	.....	192,906	.....	22,380	.....	215,286
November	.....	335,767	.....	54,638	.....	390,405
December	.....	341,524	.....	65,492	.....	407,016
Total	.....	2,126,066	.....	529,711	.....	2,655,777

Passenger Car and Truck Production

(U. S. and Canada)

	April 1939	March 1939	April 1938	FOUR MONTHS 1939	FOUR MONTHS 1938	FOUR MONTHS Per Cent Change
Passenger Cars—U. S. and Canada						
Domestic Market—U. S.	257,058	279,148	160,028	1,023,176	563,513	+ 82.0
Foreign Market—U. S.	16,351	20,555	16,050	69,949	81,515	− 14.3
Canada	12,791	12,689	14,033	47,798	51,447	− 7.0
Total	286,200	312,392	190,111	1,140,923	696,475	+ 64.0
Trucks—U. S. and Canada						
Domestic Market—U. S.	50,981	57,500	31,837	203,014	134,288	+ 51.0
Foreign Market—U. S.	12,982	14,737	11,395	50,166	57,848	− 8.2
Canada	4,100	4,860	4,786	15,736	17,864	− 6.9
Total	68,063	77,097	48,018	268,916	210,000	+ 28.0
Total—Domestic Market—U. S.	308,039	336,648	191,865	1,226,190	697,801	+ 75.5
Total—Foreign Market—U. S.	29,333	35,292	27,445	120,115	139,363	− 5.8
Total—Canada	16,891	17,549	18,819	63,534	69,311	− 8.3
Total—Cars and Trucks—U. S. and Canada	354,263	389,489	238,129	1,409,839	906,475	+ 55.2

Truck Production by Capacities

(U. S. and Canada)

Four Months 1939 and 1938 Compared

	Four Months 1939	Four Months 1938	Per Cent Change	Per Cent of Total 1939	Per Cent of Total 1938
1½ Tons and less	247,871	196,574	+ 26.1	92.17	93.61
2 to 3 tons	12,108	7,032	+ 72.2	4.50	3.35
3½ Tons and over	4,000	3,089	+ 29.5	1.49	1.47
Special and buses	4,937	3,305	+ 49.3	1.84	1.57
Total	268,916	210,000	+ 28.0	100.00	100.00

New Method for Finding Bearing Surface Wear

The National Bureau of Standards has developed a new method for measuring the amount of wear which takes place on the bearing surfaces of machinery, the Department of Commerce has announced. This method consists of making minute indentations in the surface of the bearing by means of a specially shaped diamond point and measuring the dimension of the indentations both before and after the bearing has been subjected to use.

The dimensions of the indentation of the bearing surfaces change in accordance with the amount of material which is worn off the bearing by use. It was pointed out that by measuring the changes in the dimensions of the indentation it is possible to quickly and accurately determine the extent of wear that has taken place on the bearing surface.

Olds May Sales

Retail sales of Oldsmobile Sixes and Eights continued their upward trend, and for the month of May totaled 13,034 for a gain of more than 28 per cent over the 10,151 cars sold during May last year, according to a statement issued by D. B. Ralston, Oldsmobile's general sales manager.

"Oldsmobile sales for the first five months of this year now total 60,730 units to show a gain of 47 per cent over the 41,369 cars sold by our dealers during this same period last year," Ralston said.

Large Order for Yellow Truck

The War Department has awarded a $1,038,379 contract to the Yellow Truck & Coach Mfg. Co., Pontiac, Mich., for 814 cargo trucks, the largest single contract for motor vehicles awarded by the office of the Quartermaster General in a number of years.

To be assigned for use by the National Guard, the trucks ordered will be of the 1½-ton (LC), 4x4 cargo type.

Chevrolet May Sales

For the first time since 1933, Chevrolet dealers' May deliveries of new passenger cars and trucks this year eclipsed those of April. The announcement was made at company headquarters in connection with the release of figures showing the month's new deliveries as 77,125 units. This was 34.8 per cent above the total for May a year ago, and is the second-highest month since the 1939 models' introduction.

Truck deliveries for the month were 15,474, as against 11,436 in May, 1938.

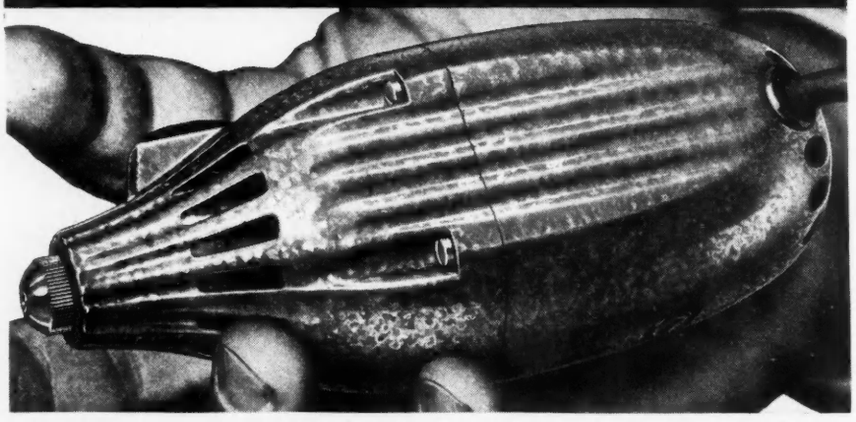
Reo Hearing Postponed

Hearing on the reorganization of the Reo Motor Car Co. was adjourned until July 10 by Judge Arthur F. Lederle in the U. S. District Court in Detroit when further proceedings opened before him on June 8. Counsel for the Trustee, Theodore I. Fry, was instructed to be prepared at that time to supply the court with details as to how the company would raise two million dollars in operating capital through an RFC loan. The plan presented to the court calls for payment of all creditors with claims of less than $500, segregation of one million dollars in assets for payment of larger creditors, and raising of working capital through an RFC loan.

Buick May Sales

Domestic retail sales of Buick motor cars during May totaled 19,730 units, comparable to the best month in the company's experience, while used car sales established an all-time record, it was announced by W. F. Hufstader, general sales manager. The month's volume compared with 13,841 in May last year, a gain of 42.5 per cent.

DURO HEAVY ☆ DUTY GRINDERS



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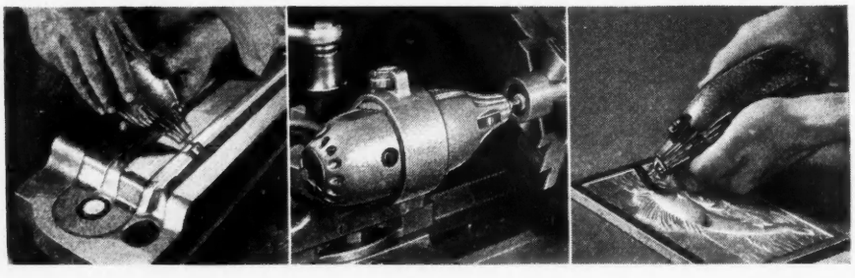


News from the Orient

(*Continued from page* 727)

There have been several barter agreements under which manchurian produce is being shipped in exchange for German machinery, mostly heavy metallurgical and mining equipment, and the only credit so far extended is redeemable within three years, also in Manchurian produce.

Diesel Project Fails

The Nippon Diesel Engineering Co., in which the German Krupp-Junkers concern has an interest in the shape of patent rights valued at Y2,410,047, has abandoned its original plan to produce high-speed Diesel engines for automobiles because of difficulties in procuring the necessary machinery from Germany.

In place of Diesels, the company is manufacturing munitions, aircraft parts and general machinery. One of the directors of the company was formerly connected with Krupp, Essen.

Committee To Study Management Technique

The Ministry of Commerce & Industry in Tokyo has established a committee for the study of various automotive manufacturing problems. The committee will not only investigate questions pertaining to materials, design and testing, but will also pay special attention to the improvement of management technique and factory planning.

Japan Protects Auto Secrets

Japan has enforced a law for the protection of secondary military secrets, which include production capacities for and stocks and imports of commodities other than arms which can be put to military use.

Specific mention is made of cars and trucks and their parts, and even horses.

In practice, there will be no considerable change since the publication of automotive production and import figures was suspended two years ago.

Obviously in preparation for large-scale commandeering of civilian automobiles, the Government has enacted a law which obliges owners of cars and trucks to submit their vehicles to official inspection and to render cooperation in the inspection.

Ford May Sales

Sales of Ford cars, trucks, and Mercury cars showed a sharp increase in May, it was announced at the offices of the Ford Motor Co. The month's sales, totaling 69,816, were 44 per cent greater than May a year ago; and 12 per cent over April this year. Mercury sales showed an increase of 20 per cent over the previous month.

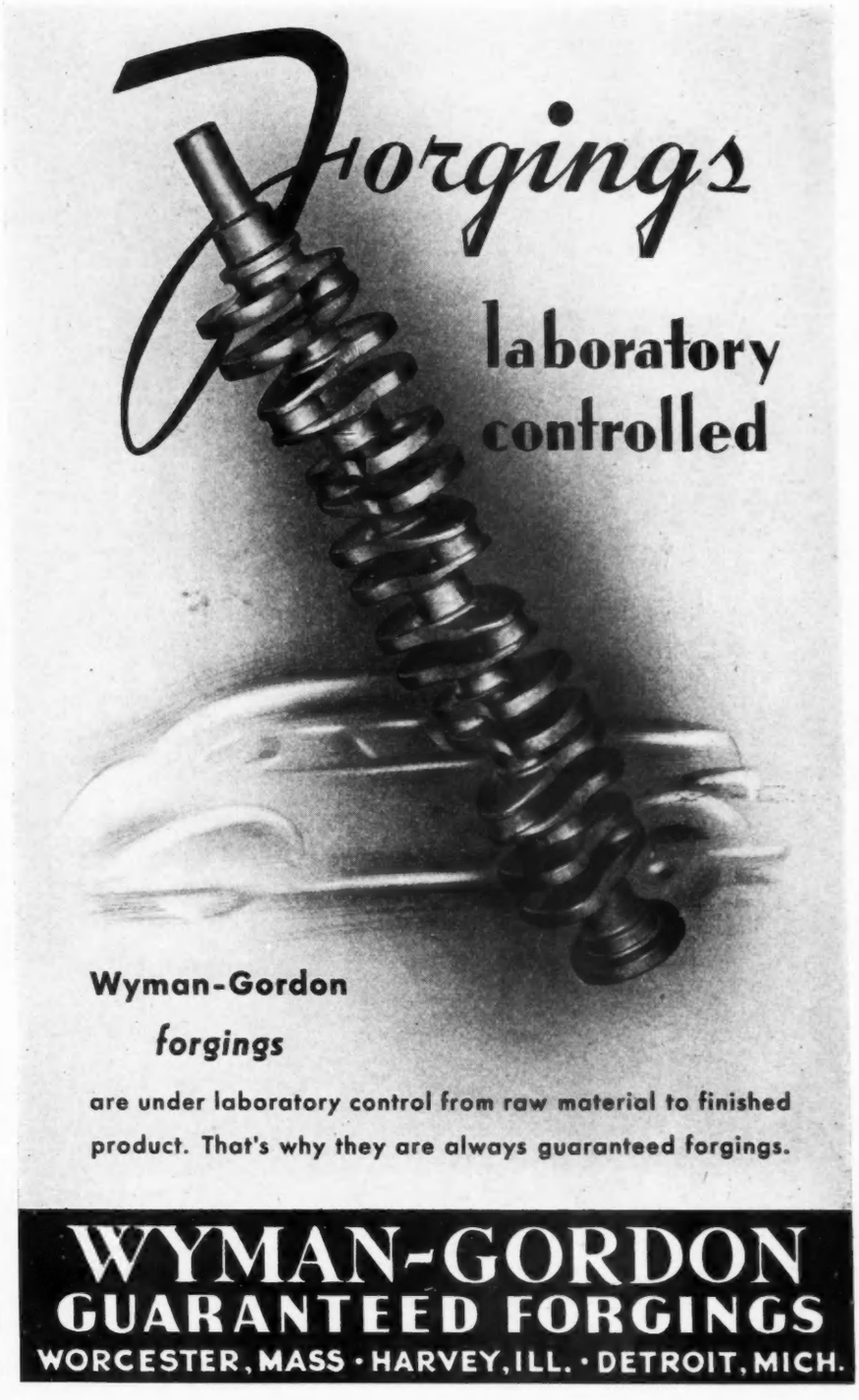
Sales of the 1939 model cars and trucks were 51 per cent greater up to June 1 than the 1938 cars and trucks for the same period. This represents a higher per cent of increase in business during the first seven months of the model year than any similar period since fall introductions of yearly models began in 1935.

General Motors May Car Sales

May sales of General Motors cars and trucks from all sources of manufacture totaled 145,786 compared with 104,115 in May a year ago, according to a report by the corporation. Sales in April were 158,969. Sales for the first five months of 1939 totaled 794,039 compared with 512,045 for the same five months of 1938.

Sales to dealers in the United States totaled 112,868 in May compared with 71,676 in May a year ago. Sales in April were 126,275. Sales for the first five months of 1939 totaled 614,740 compared with 347,052 for the same five months of 1938.

Sales to consumers in the United States totaled 129,053 in May compared with 92,593 in May a year ago. Sales in April were 132,612. Sales for the first five months of 1939 totaled 575,843 compared with 422,049 for the same five months of 1938.



Men

(*Continued from page 729*)

Battery Manufacturers Association. He succeeds **W. J. Parker**, who has resigned after 12 years in that office to devote his entire time to the organizing and managing of National Trade Associations.

Walter E. Blanchard has been appointed operating manager of the National Automobile Dealers Association. Mr. Blanchard has been serving as acting general manager since the resignation of A. N. Benson in February.

National Electric Welding Machines Co. has announced the appointment of **L. E. Nichols**, formerly its chief welding engineer, as technical advisor and sales engineer for the Detroit district sales division.

Edwin J. Schwanhausser has been elected a vice president and works manager of Worthington Pump and Machinery Corp.

The promotion of several American Rolling Mill Co. men to executive positions has been announced. **F. E. Vigor**, manager of the Ashland, Ky., division, has been appointed general transportation manager; **R. R. Smith**, general superintendent of the Ashland division, will succeed him as manager; and **R. G. Adair**, assistant director of personnel and public relations, has been appointed assistant manager of Armco operations in Ashland.

The following officers were elected at the meeting of the board of directors of the Norma-Hoffmann Bearings Corp.: **W. M. Nones**, chairman of the board; **O. P. Wilson**, president and treasurer; **H. J. Ritter**, vice president and secretary; **C. B. Malone**, vice president in charge of plant operations. The board also made the following appointments: **E. C. Lennon**, assistant secretary and assistant treasurer; **J. J. Jenkins**, auditor.

Frank W. Klatt has returned to the W. W. Sly Mfg. Co. as general manager, a position he formerly occupied from 1920 to 1927.

Joseph Geschelin, Detroit Technical Editor, AUTOMOTIVE INDUSTRIES, will address the National Petroleum Association at a luncheon meeting June 22, in Detroit. The talk will deal generally with engine developments, current and future trends.

N. A. Lincoln has been appointed works manager of Evans Products Co.

Henry A. Weyer, formerly with the Nazel Engineering & Machine Works, is now associated with the Chambersburg Engineering Co.

Dr. Jesse E. Stareck, now engaged in research with United Chromium, Inc., on May 17 received the Edward Longstreth medal of the Franklin Institute in Philadelphia for his discovery of electrolytic color plating.

Robert K. Jack, formerly chief engineer of Olds Motor Works and Durant Motor Co., is now chief engineer of the Reo Motor Car Co.

K. J. DeJuhasz, associate professor of engineering research at the Pennsylvania State College, has been awarded the Levy gold medal by the Franklin Institute of Philadelphia for his paper on "Graphical Analysis of Surges in Mechanical Springs." This paper appeared in the Journal of the Franklin Institute for October, 1938, and has recently been issued in pamphlet form.

Andrew Court, manager of the research department in the Detroit offices of the Automobile Manufacturers Association, was reported to be convalescing satisfactorily after an emergency appendectomy on May 29.

J. F. Wiese, who since 1935 has been assistant to the vice president of Lukens Steel Co., has been appointed general manager of sales.

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H-T LUBRICATION
Ideal lubricants for equipment which operates at temperatures above the burning point of petroleum oil are prepared by dispersing "dag" in suitable fluids, volatile at these temperatures. The quick evaporation of the carrier fluids leaves a clean, dry lubricating film of pure "dag" which physically combines with the bearing surface — reducing wear, carbon and flake-off.
"Dag" colloidal graphite is non-gumming, odorless, chemically inert and non-oxidizing — it is economical and *cleans up* the problem of H-T lubrication for conveyors and baking ovens, in glass making and ceramic machines, for projectors, die casting and permanent mold equipment, etc.
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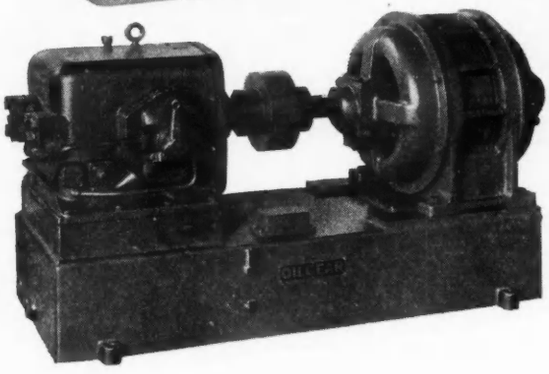
Above–OILGEAR machine for broaching large connecting rods and caps for Diesel engines. *At left*–Two-way variable displacement Bantam Bearing equipped fluid power pump.



THIS giant machine, for broaching with precision accuracy large connecting rods and caps for Diesel engines, is believed to be the largest of its type ever built. It weighs nearly 30 tons; removes 100 pounds of metal and produces 50 completely finished rods and caps per hour. The smooth "fluid power" behind its 120,000 lbs. capacity depends on Bantam radial roller bearings, 13¾" O.D. and 9" O.D., for long life and dependable, trouble-free operation.

In the machines you *buy* and the machines you *build*, Bantam Bearings offer advantages which it will pay you to investigate.

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QUILL BEARINGS
SHAFT SIZES 1/2" to 5"
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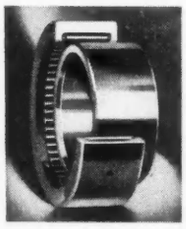
Provide high load carrying capacity in limited areas . . . Easy to install . . . Low cost. Exclusive features include (A) One-piece channel-shaped outer race, (B) Specially designed curvilinear trunnions on rollers, (C) Improved method of roller retainment, (D) Simplified design with all fragile parts eliminated, (E) Supplied with or without hardened and ground inner race.



BANTAM BEARINGS

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FTC Investigation

(*Continued from page* 723)

manufacturer-dealer relations. "This statement applies to conditions at the present time as well as in the past, although during 1938 the methods of supervision employed were less direct than in former years.

"Many instances which were disclosed by the Commission's inquiry confirm complaints of the types made to the Congress at the time the inquiry was under consideration. Under threat of fear of cancellation, some dealers have reported they felt compelled to operate their businesses in such a manner that their profits were wiped out and even their investments were largely dissipated."

The FTC said its investigation disclosed some cases in which the dealer, upon cancellation of his contract, not only had nothing in prospect, but also was burdened with a substantial investment in buildings, leaseholds, equipment, stocks of used cars, accessories and parts, in the liquidation of which he often sustained a heavy loss. Also, "some dealers reported that in fear of cancellation, or refusal to renew contracts, and faced with such injurious consequences, they have, against their best business judgment, accepted terms and adopted policies dictated by the manufacturer."

The report noted that some of the smaller manufacturers have recently featured claims of "friendliness" and "fairness" as characterizing their attitude toward their dealers and have cited changes in their 1939 contracts as indicating "a better deal for dealers." Pressure exerted by the largest three manufacturers on many dealers to take and sell new cars, was reported by the FTC, which said that some manufacturers have cancelled the contracts of dealers who do not attain the desired sales volume. It was added, however, that this pressure has been less severe since the inquiry was ordered.

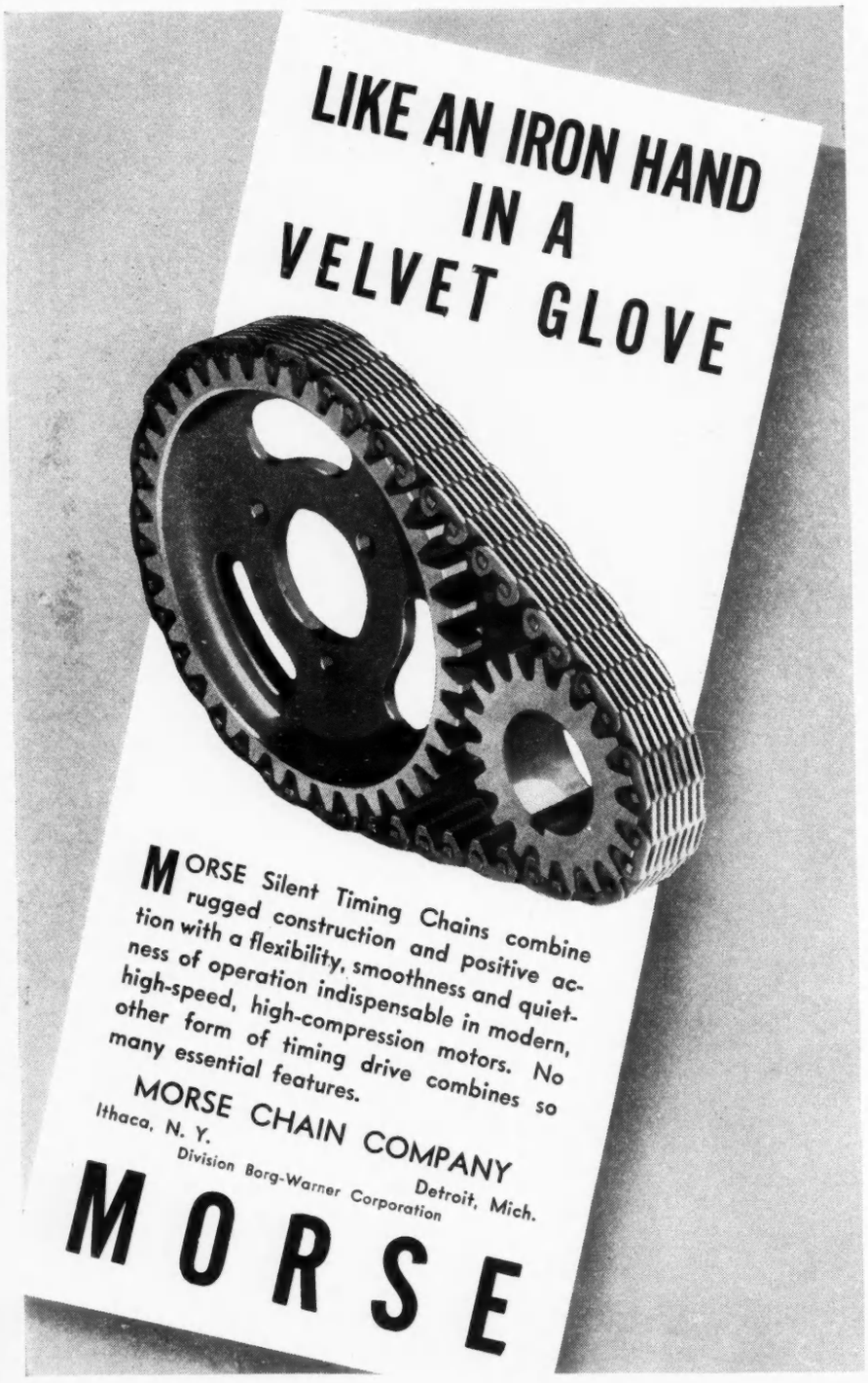
The report recommended that "present unfair practices be abated" so that dealers will have: (1) less restriction upon the management of their own enterprises; (2) quota requirements and shipments of cars based upon mutual agreement; (3) equitable liquidation in the event of contract termination by the manufacturer; (4) contracts definite as to the mutual rights and obligations of manufacturers and dealers, including specific provision that the contract will be continued for a definite term unless terminated by breach of reasonable conditions recited therein.

On the other hand, the report suggested that retail dealers set their house in order so as to protect purchasers against over-charges, insisting that there is a need of regulation requiring them to furnish each purchaser with an itemized invoice showing in detail the components of the cash sale price, including the components of charges added to the cash sale price by reason of the fact the vehicle is sold on a time basis; and the amount of the finance charge.

The Commission also was critical of the pricing system employed in the automobile industry, asserting that the practice of charging the purchaser an amount greater than the transportation cost to the manufacturer or dealer is "an unjustifiable imposition upon the purchasers of such vehicles and should be eliminated." The transportation charge, representing an addition to the factory price, may be greater than that actually incurred by the manufacturer or dealer, the FTC explained, because of differing methods of transportation and delivery.

Noting that numerous dealers had complained that the largest three manufacturers coerced and forced them to purchase large stocks of accessories and replacement parts, the Commission did not disclose that such evidence had been uncovered but it cited the records of larger manufacturers showing that they made larger profits on accessories and parts than on cars.

Referring to the "6 per cent plan" for financing automobile sales, the subject of two pending complaints involving General Motors and Ford, the FTC report recognized that "the application of this plan constituted a substantial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MORSE Silent Timing Chains combine rugged construction and positive action with a flexibility, smoothness and quietness of operation indispensable in modern, high-speed, high-compression motors. No other form of timing drive combines so many essential features.
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reduction from the rates of finance charge and interest that were in general use just previously." What the FTC regards as "more serious deceptions" is the practice of "padding"—additions made for no extra service by the dealer to the regular finance charges—which the Commission said have been engaged in generally by the dealer in connivance with a finance company.

Among 30 finance companies examined, one company was found that systematically failed to afford car purchasers a portion of the insurance protection for which they were charged, the report said, adding that "some of the financing companies have permitted dealers to impose exorbitant charges and have practiced serious deception or even direct defrauding of the purchaser."

The FTC also expressed the view that the practice of some retail dealers of selling as new cars those which have been towed or driven from the factory or used as demonstrators, unless the full facts, including the miles driven, are disclosed to the purchaser, is deceptive and unfair and should be eliminated.

Representatives of the Automobile Manufacturers Association did not protest against the inquiry but went on record as being opposed to any investigation whose purpose might be to bring about conditions leading to price-fixing or to unreasonably or unnecessarily increase prices to consumers. The approved resolution gave the FTC a year to complete its investigation. The extended delay in releasing the report following the April, 1939, deadline, was reportedly due to disagreement among Commission members as to what form recommendations for remedial action should take.

Publications

(*Continued from page* 724)

"Facts About Grinding Wheels" is the title of a 75-page booklet published by Norton Co., abrasive manufacturers.*

Wothington Pump and Machinery Corp. has released a folder illustrating and describing its **evaporative coolers for engine jacket water.***

A new **coil-spring clutch plate** (the S-type power-flex clutch plate) is described in a folder published by the Accurate Parts Manufacturing Co.*

The Armour Institute of Technology has published the **proceedings of the Midwest Power Conference.** Copies of the 150-page book are available from the institute, in Chicago, at two dollars each.

Bendix Radio Corp. has published an **automotive and radio electrical test equipment** catalog.*

Anaconda Wire and Cable Co. has available a new catalog covering **rubber insulated power cables.***

The Speedmaster Co., division of Continental Machines, Inc., has released a folder describing its new **variable pulley for variable speed machines.***

Two illustrated booklets, one graphically presenting **information on spark plugs** and the other telling the story of the **ignition system and engine performance** are announced by the AC Spark Plug division of General Motors.*

"Stopping Profit Leaks Beyond the Production Line" is the title of a new booklet being distributed by Acme Steel Co. The booklet describes the **causes of excessive packing and shipping costs and the methods for eliminating those costs.***

"Hard Facts About Modern Valve Mechanisms," a folder by Wicox-Rich division of Eaton Manufacturing Co., discusses **Zero-Lash hydraulic valve lifters.***

National Broach and Machine Co. has released a folder on its Red Ring G.S.B. **Gear Speeder.** The device is essentially a sound amplifier which at the same time eliminates all interference from sounds other than those produced by the gears being tested.*

Acme Steel Co. has published a folder on **carload bracing procedures.***

Flexrock Co. has published a 56-page **handbook of building maintenance.***

Bakelite Corp. has issued a new booklet which is designed as a primer—a **business man's guide to modern plastic materials.***

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

● Cutting costs without sacrificing finish and accuracy is a problem in every shop. Cities Service Cutting Oils in your shop may be the answer to your problem.

Cities Service Cutting Oils are *Service Proved.* They have been proved, through many years of service to the metal working industry, to be oils that turn out work that meets the demands of the most discriminating customers.

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A new booklet "Metal Cutting Lubrication—In Theory and Practice," is on the press. Write for your free copy.

This is the "Heat Prover"—an ingenious device that might be helpful to you. It's a by-product of our research in metallurgy. It registers, continuously and instantaneously, changes in the amount of oxygen and combustibles in furnace gases. Invaluable in the heat treatment of metals,—assures uniformity and reduces scrap losses. Let us tell you how you can obtain the use of one.

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SERVICE PROVED INDUSTRIAL OILS

Triple Casting

(*Continued from page 702*)

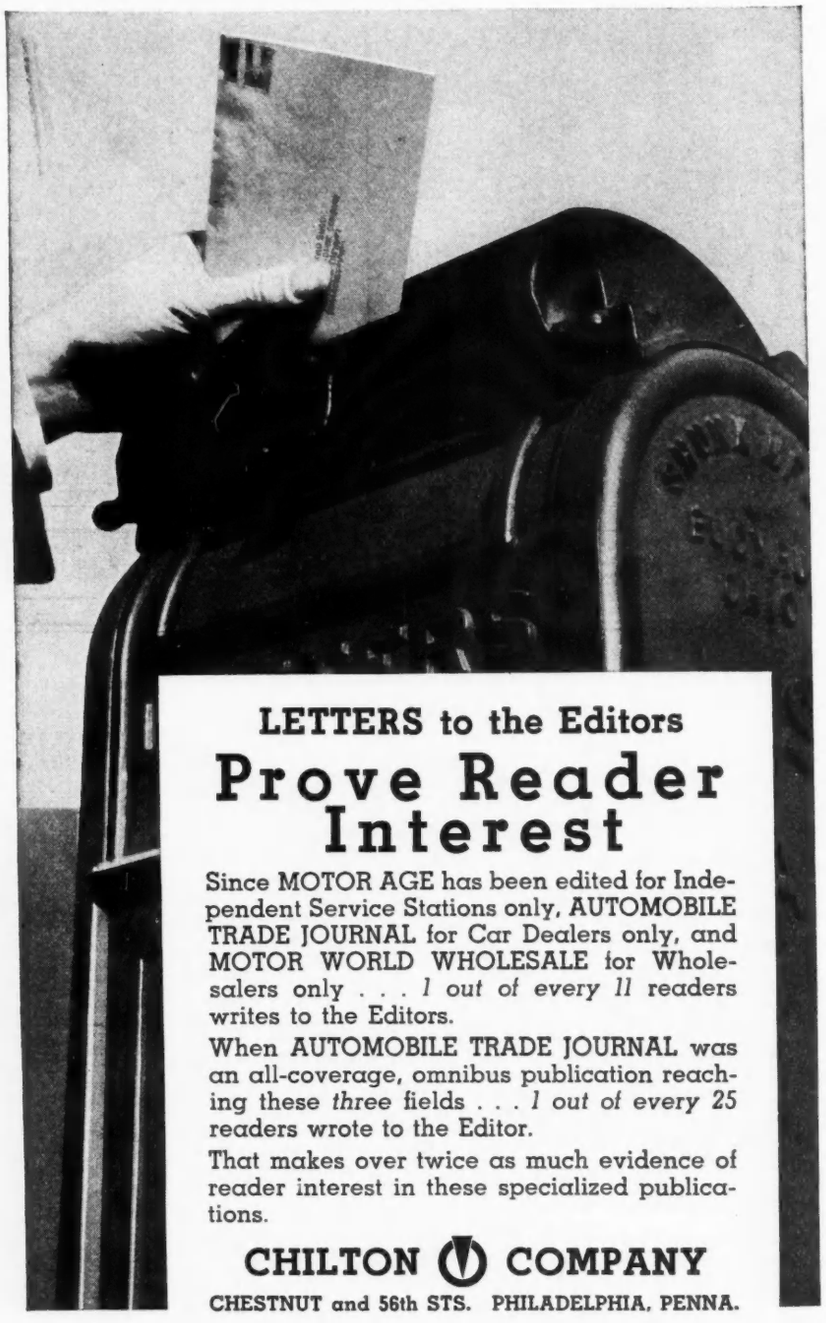
claimed to have unusual wear-resisting qualities due both to the concentration of graphite and its natural formation. This metallurgical characteristic is said to protect both rings and cylinder walls against initial wear during the break-in period, and to maintain this protection during the life of the ring.

Uses for Glycerine in Modern Aircraft

Glycerine plays an important role in airplane production as an ingredient of the many types of alkyd or glycerol-phthalate resins. These resins are standard ingredients of airplane "dopes" and of other protective coatings. The use of the glycerine-containing resins imparts strength, flexibility and high resistance to these compounds. The alkyds are also used as laminating agents and adhesives in making plywoods, and in making "safety" glass for airplane use.

Rubber substitutes with highly desirable properties such as resistance to oil, oxidation, etc., are often made with glycerine as a major constituent.

Glycerine as such finds usage, too, in the manufacture of special lubricants, oil- and grease-proof gaskets and packings, insulating compounds, and in compasses, such as the earth inductor compass. It is used in many types of de-icing mechanisms and, in addition, is a constituent of special compounds which help prevent ice formation on airplane wings. Further, glycerine may be employed as an anti-freeze agent in airplanes, and can be utilized as a cooling medium for the engines, since it does not evaporate readily.


LETTERS to the Editors
Prove Reader Interest
Since MOTOR AGE has been edited for Independent Service Stations only, AUTOMOBILE TRADE JOURNAL for Car Dealers only, and MOTOR WORLD WHOLESALE for Wholesalers only . . . 1 out of every 11 readers writes to the Editors.
When AUTOMOBILE TRADE JOURNAL was an all-coverage, omnibus publication reaching these three fields . . . 1 out of every 25 readers wrote to the Editor.
That makes over twice as much evidence of reader interest in these specialized publications.
CHILTON COMPANY
CHESTNUT and 56th STS. PHILADELPHIA, PENNA.

FWD Buys Clark Heavy Duty Cab Business

Mr. Walter A. Olen, president and general manager of The Four Wheel Drive Auto Co., recently announced the purchase of the heavy duty cab business of the J. L. Clark Manufacturing Co. Mr. Olsen said the Clark concern has a production schedule of about six weeks to be completed at its present plant. As departments finish their work, machinery, patterns and drawings will be moved to Clintonville, home of FWD.

While the FWD was the largest buyer of Clark cabs, the concern built cabs for other truck companies, and it is planned to continue this policy.

CALENDAR

Conventions and Meetings

SAE World Automotive Engineering Congress .....May 22-June 8

American Society for Testing Materials, Annual Meeting, Atlantic City .....June 26-30

Automotive Engine Rebuilders Association, Seventeenth Annual Convention, Baltimore, Md. .....July 5-7

National Petroleum Association, Annual Meeting, Atlantic City, Sept. 14-15

American Welding Society, Annual Meeting, Chicago .....Oct. 22-27

American Trucking Association, Annual Meeting, Chicago .....Oct. 23-24

American Petroleum Institute, Annual Meeting, Chicago .....Nov. 13-17

National Independent Traffic League, Annual Meeting, Chicago....Nov. 23-24

Shows at Home and Abroad

National Machine Tool Show, Cleveland .....Oct. 4-13

Great Britain, London, Automobile Show .....Oct. 12-21

National Automobile Show, New York, Oct. 15-21

American Society for Metals, International Amphitheatre, Chicago, Oct. 23-27

Italy, Milan, Automobile Salon, Oct. 25 to Nov. 11

International Automobile, Motorcycle and Motor Boat Show, Budapest, Oct. 27 to Nov. 6

Great Britain, London, Commercial Automobile Transportation Show, Nov. 2-11

National Truck Show, Chicago....Nov. 8-16

Great Britain, Glasgow, Scotch Automobile Show .....Nov. 10-18

Economy, Comfort, Safety

(*Continued from page* 724)

ise and I feel that window regulators could be made much more efficient and consequently lower in cost. The formidable array of buttons on the dash could also be, in my mind, redesigned to reduce the number and the cost; and both the radio and the heater are too bulky and too expensive. The development of accessories has shown very good progress but I am sorry to say that the over-all cost of a complete accessory equipment for a car is out of all proportion to the cost of the car itself.

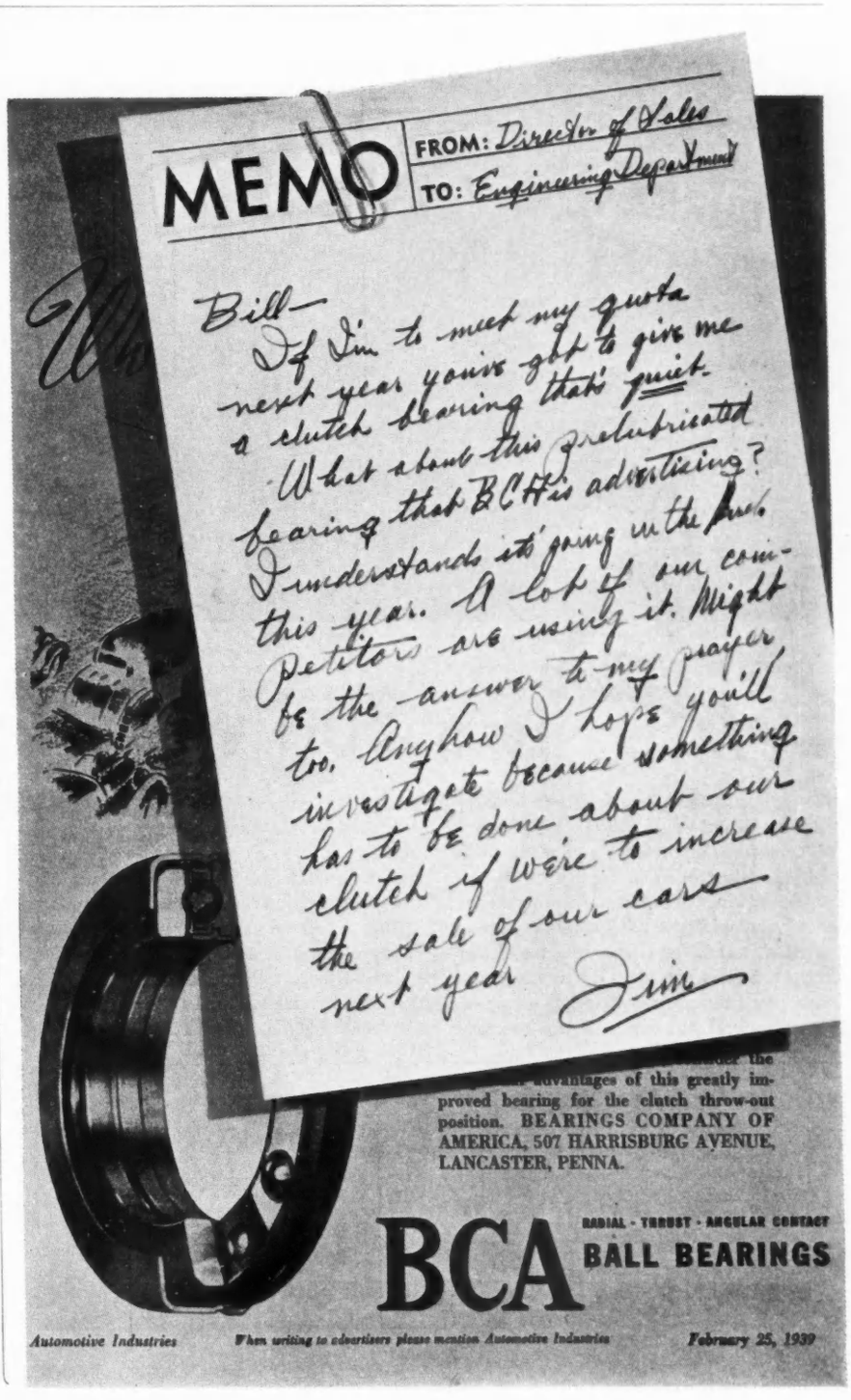
"Coming to the what we might call 'forward program' in automobile engineering, there is not room enough in my imagination to forecast what the ultimate is—you might say that the sky is the limit, as engine, transmission and axles lend themselves to constructive forward research. The rapid development of chassis and body construction has left these units more or less stereotyped with the exception of the front system, on which individual springing today is generally accepted. What can be done on the engine, nobody knows. We seem to be about stationary at about five pounds plus per horsepower, and the manufacturing technique of the industry has produced this kind of an engine at very reasonable cost. However, when you compare aviation engines at one and one-half pounds per horsepower, there would seem to be room for progress in the smaller engines—not to one and one-half pounds, of course, but say to four and one-half pounds. Transmissions show a definite trend toward overdrive, both automatic and manual, and the fluid flywheel is just a question of cost. Engines in the rear of the car seem to have reached an impasse for the moment, but the independently sprung rear axle is surely in the picture in the not too distant future. In the body-frame combination, there lies, to my mind, the greatest possibility for weight saving and, of course, cost saving, too. We in America have been rather backward on the subject of body-frame combination, perhaps because of the size and performance of our cars, but it seems to me that some way could be found to combine the body underpan with the frame in one piece and accomplish substantial weight saving without any great sacrifice in structural strength. With the progress made in welding processing, this would seem a reasonable assumption."

Industrial Statesmanship Must Accelerate Progress

(*Continued from page* 694)

the point that it seems to me that the thinking of our people, their attitude toward progress had changed importantly in that five years. At that time, if you will recall, there was a very deep feeling of apprehension as to whether our institutions were even going to continue. There was a feeling that something was going to happen that would revolutionize our whole scheme of things. Today, it seems to me, it is not a question of that but, it seems to me, there is growing a consciousness that not everything is right —many things are wrong—on the part of more and more people, and they are making a serious attempt to inquire what we ought to do about it—what we can do to capitalize our manifest advantages.

I want to repeat what I said a while ago, that the problem of wealth can only be solved in a physical way. We must again have more materials taken from the mines, and the other sources of materials, and send them down our highways of technological processes to be transported into useful things that people enjoy. Why is it today, when this country has almost every natural resource that is needed—very few we haven't—and in great variety; why is it we have the finest manufacturing plants in the world, bar none; why is it that we have the very best manufacturing technique; why is it that we have the greatest inventive geniuses among our people that the world ever saw; why is it that our people are

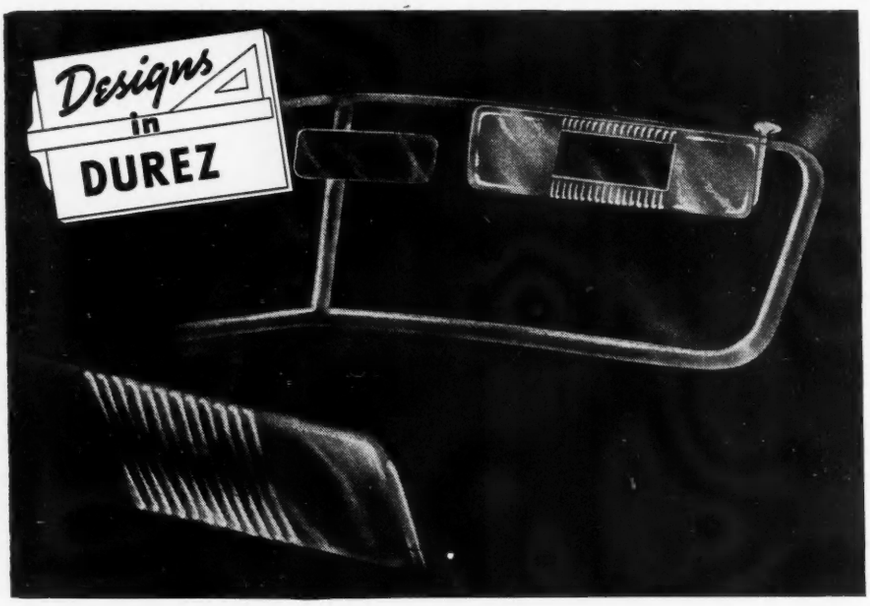

MEMO
FROM: Director of Sales
TO: Engineering Department
Bill—
If I'm to meet my quota next year you've got to give me a clutch bearing that's quiet.
What about this prelubricated bearing that BCA is advertising? I understand it's going in the Ford this year. A lot of our competitors are using it. Might be the answer to my prayer too. Anyhow I hope you'll investigate because something has to be done about our clutch if we're to increase the sale of our cars next year
Jim
advantages of this greatly improved bearing for the clutch throw-out position. BEARINGS COMPANY OF AMERICA, 507 HARRISBURG AVENUE, LANCASTER, PENNA.
BCA
RADIAL · THRUST · ANGULAR CONTACT
BALL BEARINGS
Automotive Industries
When writing to advertisers please mention Automotive Industries
February 25, 1939

willing to work for what they want, and yet we have eleven million people out of work. There must be something wrong some place. We don't know how to manage our affairs or that couldn't possibly exist. It seems to me what we fear is that we have too much of everything. It seems to me that instead of feeling inspired by our riches, we are frightened by their quantity and their diversity. It seems to me, instead of doing those things that promote great production, we are doing everything we can to limit the creation of physical wealth. It seems to me that instead of capitalizing the theory of plenty, which is open to us, we are promoting in every way the theory of scarcity. Apparently, we have too much land. We reduce the yield. We seem to think we have too many factories, notwithstanding everybody wants more. Most everybody has too little, and millions of our people have practically nothing at all. We seem to have too much labor to produce the things so many people want; therefore, we rack our brains to devise means for limiting the output and reduce the work done by the worker. We seem to have too much capital; we worry about how to reduce the savings, and set up all kinds of barriers about how not to increase our savings, for fear they will produce more goods. We have the foundation of wonderful things we have accomplished, and yet we are beginning to study a plan for slowing up technological progress, and even attempting to tax it out of existence. We have too much gold, so we bury it in Kentucky. We have too much influence in the world's affairs, so we adopt devices for making ourselves as unimportant as possible.

Does anybody want any more evidence that we are proceeding on the theory of scarcity, when we should be promoting the theory of plenty?

The only way we can possibly solve our problems of unemployment today is capitalizing more than we ever have before the advantages of an advanced technology. Half of our employable workers are involved in the capital goods industry. This country has never had a protracted period of reasonable prosperity that the capital goods industries have not supported the economy to an important degree. During the past few years as, of course, you know, the capital goods industries have been sub-normal.

There is a most wonderful opportunity before American industry to rebuild America with the instruments of productivity available through our technology of today. If it were possible to develop the necessary foundation of confidence, which we must have sooner or later unless we are to enter a state of chaos, the amount of potential employment that is immediately available to us would be more than sufficient to eliminate the great problem of unemployment.



Suggestion For a SUN VISOR

Newest automotive idea from the versatile drawing board of Joseph B. Frederico is this spirited sketch for a sun visor to be molded of lustrous Durez plastics.

Here again, a commonplace accessory, redesigned with the advantages of Durez in mind, takes on new smartness and strength. Such a sun visor has a richness of finish and refinement of detail not possible with metal and fabric. It can be made in a wide range of colors to harmonize with any interiors. It would not chip, crack or tear...and it can be made in one piece—molded and finished with integral mounting for vanity mirror—all in one operation!

Just a suggestion—but a mighty interesting one that proves anew how easy it is to use Durez to practical advantage in your 1940 models. Write General Plastics, Inc., 96 Walck Rd., North Tonawanda, N.Y.

DUREZ phenolic plastics—Choice of the Automotive Industry for...

• Horn buttons	• Steering wheels	• Window trim	• Ash trays
• Distributor heads	• Rotors	• Dashboards	• Cigar lighters
• Hardware terminals	• Coil tops	• Glove compartments	• Radio grilles
• Control knobs	• Spark plug shields	• Shift lever finials	• Heater housings

DUREZ PLASTICS THAT FIT THE JOB

Receive SAE Awards

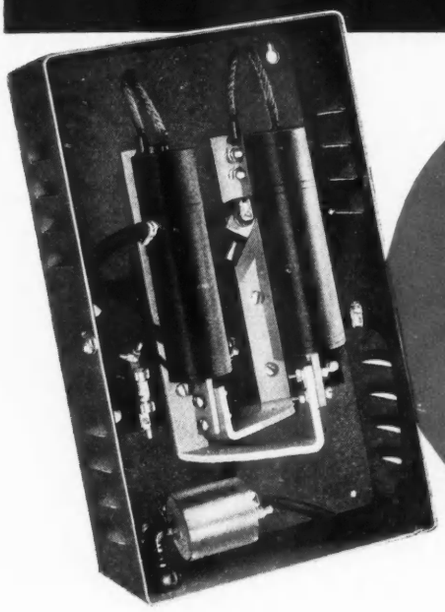
Dr. Gerald Mark Rassweiler and Dr. Lloyd Withrow, scientists in the research division, General Motors Corp., Detroit, were awarded the Horning Memorial Award of the Society of Automotive Engineers for a paper, "Motion Pictures of Engine Flames Correlated With Pressure Cards." The picture and paper were presented by the authors during the annual meeting of the society, Jan. 14, 1938, in Detroit.

The award was established by Mrs. Harry L. Horning, widow of the late president of Waukesha Motor Co., a past-president of the society, an important contributor to the development of the internal combustion engine, and a leader in the establishment of the Co-operative Fuel Research Committee which brought the petroleum and automotive industries together in research programs.

The award was presented by Dr. H. C. Dickinson, another past-president of the society and chief of the heat and power division of the National Bureau of Standards. The award was made at the general session on petroleum of the 1939 World Automotive Engineering Congress of the society.

GOOD NEWS

FOR USERS OF RESISTANCE WELDING



Weld-O-Trol

New low-cost welding contactor
Has no moving parts
Uses existing timers

The most amazing development in recent years, the new Westinghouse WELD-O-TROL is a boon to users of resistance welding.

It may be used with existing timers. There is no noise . . . no arcing contacts. Because there is nothing to wear out, it greatly reduces maintenance costs. It switches on and off 600 or more times per minute, reducing outage charges. Fool-proof in operation, it speeds up resistance welding . . . making possible far better jobs . . . without noise or confusion. Investigate what WELD-O-TROL will do in your shop. Simply mail the coupon below to Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania.

J-20825

REDUCES MAINTENANCE COSTS

WELD-O-TROL opens and closes the welder circuit without moving parts . . . gives longer electrode tip life.

USE IT ON EXISTING TIMERS

WELD-O-TROL can be adapted to your present welding timer . . . giving it the many advantages of this new Westinghouse development.

REDUCES OUTAGE CHARGES

Current turned on and off 600 or more times per minute reduces outage costs . . . speeds up resistance welding.

MAKES BETTER WELDS

There is no mechanical delay . . . no stopping and starting. WELD-O-TROL makes possible the full accuracy of the welding timer.

Westinghouse

SEND THE PROOF TO:

NAME

COMPANY

ADDRESS

CITY AND TOWN

Weld-O-Trol

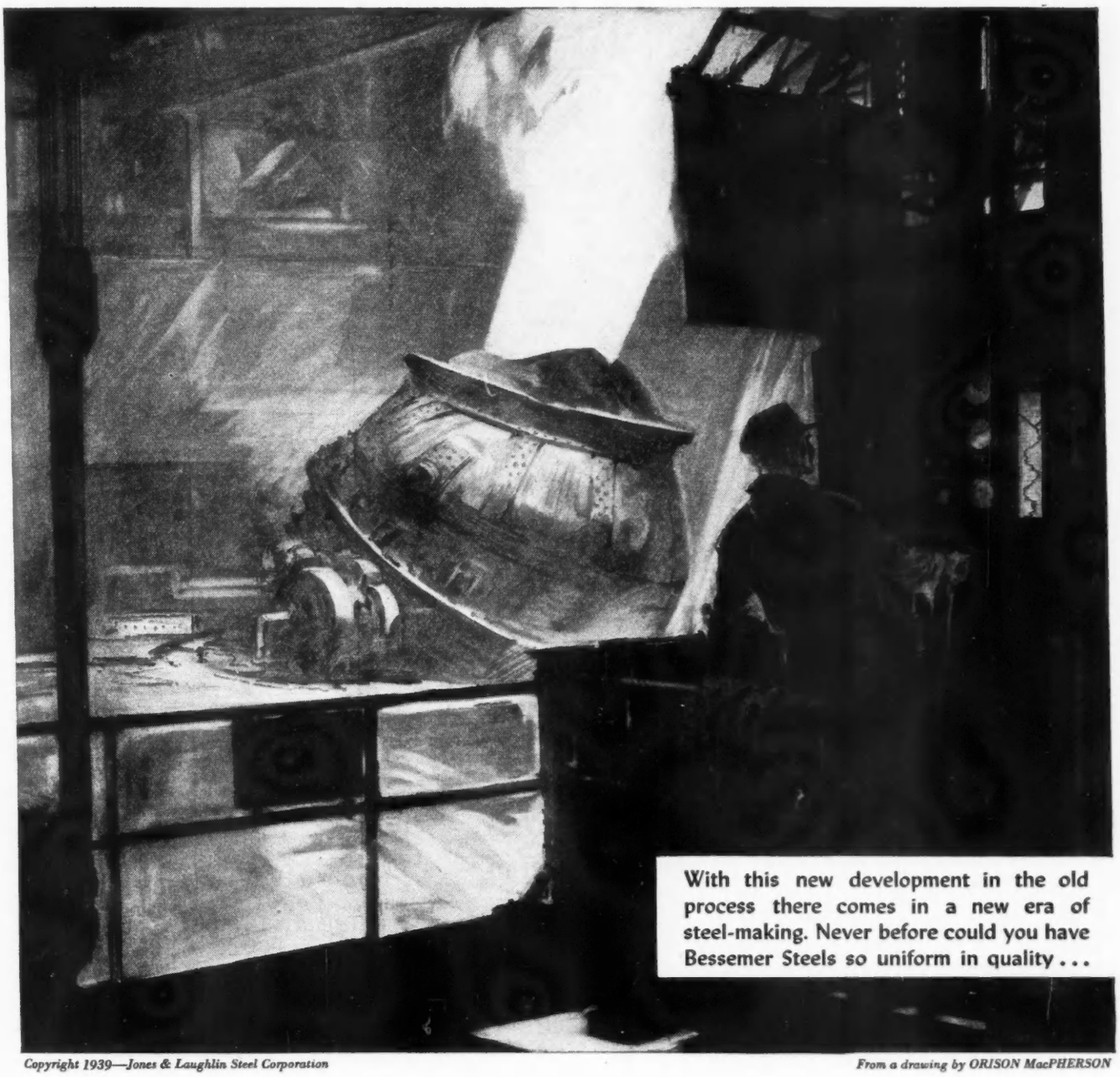
J&L DEVELOPS A NEVER-BLINKING EYE TO MAKE A BETTER STEEL FOR YOU

With this invention — for the first time, scientific control of the Bessemer process is accomplished. Today J & L converters produce constantly uniform quality steels that work better, process easier — that clear the way to new uses — new industries — greater employment.

"The forty-foot flame you see shooting from the mouth of that Bessemer is the burning off of impurities as compressed air boils through the molten iron within the vessel, 'converting' it into steel. At night, it is that colorful flame that paints the sky with the steel mill's aurora. To most of us the flame itself has little meaning, but to steel men it is the key to quality in Bessemer Steels.

"The Bessemer process was discovered more than eighty years ago and brought about this age of steel. In all these years this operation has been wholly controlled by the blower -- the man you see there at the controls. Looking into that sun-bright flame, blowers have estimated the final change in flame characteristics to catch the 'end-point' of the blow — the essential factor in obtaining the required quality. But the most skilled blowers are only human. Their eyes, however expert, are not precision instruments — they vary in vision and suffer the same strain and fatigue as yours and mine. Accordingly, the desired quality of Bessemer Steel has varied from blow to blow.

"Today — here at J & L — the Bessemer process is on a scientific basis for complete quality control. Years of work by our research metallurgists, aided by the facilities of our new Pilot Plant Laboratory — the only one of its kind — have made this precision control method possible for the first time in the industry. Its feature is a tireless, never-blinking photo-electric eye that looks into the heart of the Bessemer flame and reads and records the story of the steel with split second accuracy. This new method — 'Bessemer Flame Control' these men call it — is functioning in the control of the blow we are watching now. The molten metal boiling in that fiery vessel is destined to emerge J & L Controlled Quality Bessemer Steel.


With this new development in the old process there comes in a new era of steel-making. Never before could you have Bessemer Steels so uniform in quality . . .

Copyright 1939—Jones & Laughlin Steel Corporation

From a drawing by ORISON MacPHERSON

"With this new development in the old process there comes in a new era of steel-making—producing steels that process easier and more economically for you and all other J & L customers. Never before could you have Bessemer Steels so uniform in quality as those we are making here today—steels that pilot the way to new applications, new industries and an era of great employment. The Bessemer Flame Control is another J & L development that makes our partnership with industry one of profit to all who use steel—and this includes all mankind as we all enjoy the benefits of safety and service of steel in our daily lives."

(Note: Bessemer Flame Control is one of several methods on which patent applications have been made by Jones & Laughlin Steel Corporation.)

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS

PITTSBURGH, PENNSYLVANIA

J&L STEEL

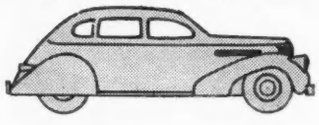
J & L — PARTNER IN PROGRESS TO AMERICAN INDUSTRY

The move to clear up that jumble behind the front panel is definitely on the way.

Relocation of the radio receiver is a big step in the right direction. And this is easy to accomplish. *A flexible shaft remote control does it*—without requiring any changes in the panel itself.

The space gained will greatly simplify the problem of locating emergency brake handle, cowl vent handle, windshield wiper mechanism, defroster tubing, heater and air conditioning units.

Your radio manufacturer can supply you with remote controlled radio. Consult him.



WRITE FOR ENGINEERING BULLETIN 38

It gives full information about S. S. WHITE Flexible Shafts, specially developed for remote control applications, with special reference to shafts for remote control of radios.

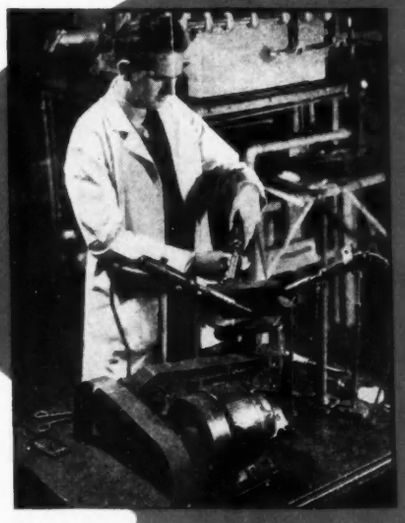
S. S. WHITE

The S. S. White Dental Mfg. Co.

INDUSTRIAL DIVISION

Department A, 10 East 40th St., New York, N. Y.

Gentlemen . . .
our Torture Chamber



Life test on soldering iron tips. The Mallory Soldaloy tips run continuously 24 hours a day through molten solder and over a steel plate.

Tarnish resistance test. Alloys for electrical contact purposes are subjected to various gaseous atmospheres, under varying electrical conditions, to determine the effect of hydrogen sulphide gas and other vapors.

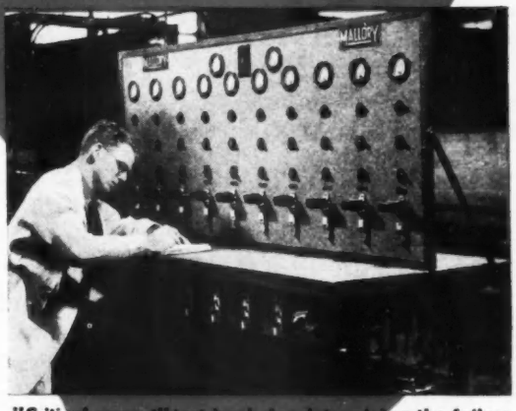
WHEN an electrical contact recommendation is made by Mallory, it is based on

1. Experience.
2. Painstaking study of the specific problem, backed by a succession of exhaustive laboratory and service tests.

The tarnish resistance and "critical current" tests, shown at right, are typical examples of the punishing treatment to which contact materials are subjected, in order to determine their fitness. Mallory metallurgists have also devised special equipment for measuring the corrosion resistance of electrical contact materials, and for studying circuit characteristics.

Whatever your contact requirements, Mallory is ably fitted to serve you. Whether you need to handle the driving force and searing heat of a lightning surge or the infinitesimal current of a light-sensitive cell, you can depend upon it that Mallory's unceasing research and development has made possible, the right type of contact . . . for these and all other classes of service.

Mallory Metallurgists are equally active in non-ferrous alloy development. Mallory alloys give exceptional performance as resistance welding electrodes and machine parts . . . springs, contact fingers, bearings, bushings, gears and other products requiring high electrical and thermal conductivity combined with great strength and hardness. Your specific inquiries are invited.



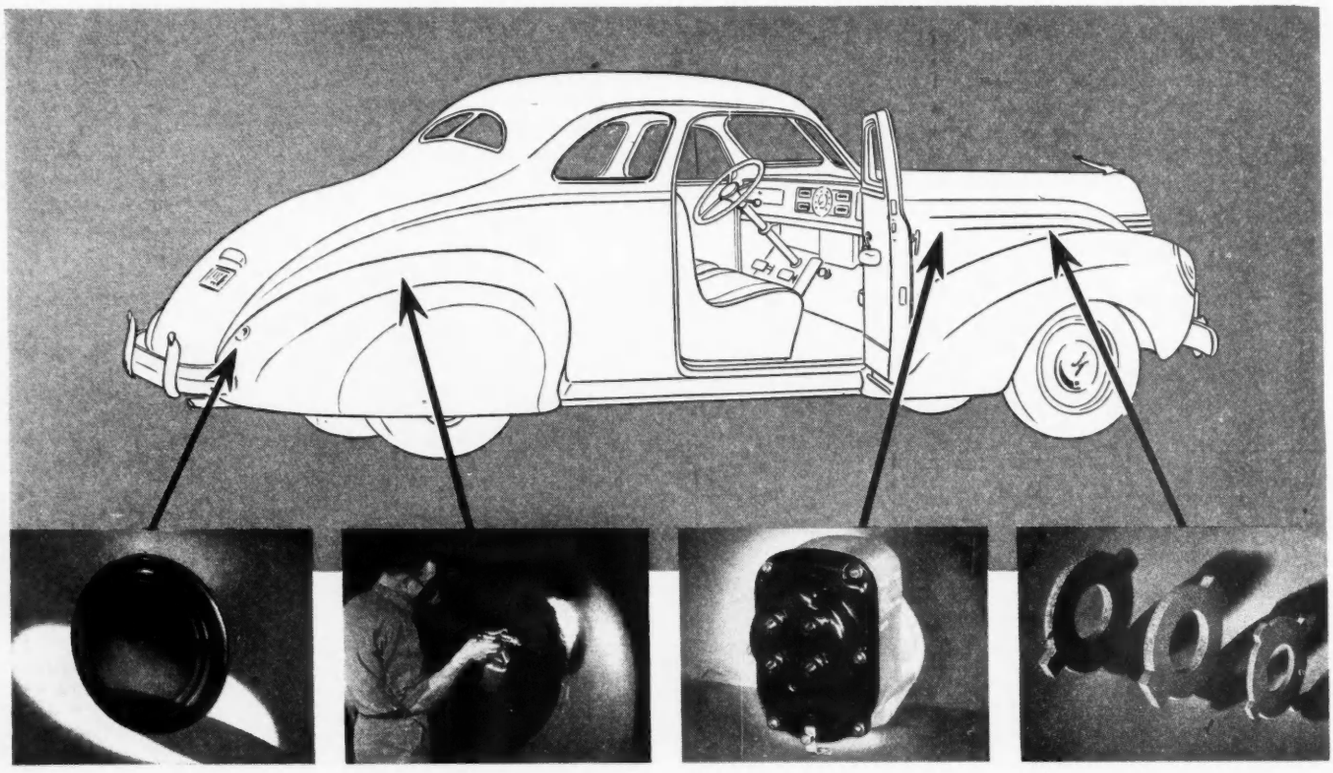
"Critical current" test bank, for determining the failure of contact materials under various circuit conditions. 30,000 operations an hour determine the current which will cause contact failure under the circuit conditions imposed.

P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA
Cable Address—Pelmallo

P. R. MALLORY & CO. Inc.
MALLORY

NON-FERROUS ALLOYS and ELECTRICAL CONTACTS

Gain MOISTURE RESISTANCE in Automotive Parts WITH BAKELITE MATERIALS



Tail-light lenses made of transparent Bakelite Molded are resistant to moisture and jolts.

Wheel and fender enamel fortified with Bakelite resin is immune to water, and indifferent to weather.

Moisture resistant distributor caps of high dielectric Bakelite Molded are standard on magnetos, such as the new P. & D. Super Chief.

Pump seals of waterproof Bakelite Laminated replace porous packing in cooling systems.

STUBBORN resistance to moisture-attack is a life-prolonging quality imparted by Bakelite materials to automotive parts—such as the four illustrated.

Baking and air-dried enamels fortified with Bakelite resins retain their lustre and color through rainstorms and repeated washings. Patented water pumps use waterproof Bakelite Molded seals instead of porous packing. Tail-light lenses of transparent Bakelite Molded withstand not only water but jars and jolts as well. Distributor caps of high dielectric Bakelite Molded provide protection against moisture, dust and oil in high output magnetos for tractors, trucks, and construction motors.

Many automotive parts function more efficiently and remain in service longer because they are made from Bakelite materials that are resistant to water, oil, heat, dielectric stress and mechanical shock. These materials are furnished in a wide assortment of colors; in transparent and translucent effects. Write for Portfolio 10 of illustrated booklets describing many types of Bakelite materials available for automotive service.

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Over 2000 Plastics at Your Service!

At Bakelite Plastics Headquarters, a vast assortment of plastic materials is available for the production of improved automotive parts. They include:

Cellulose-Acetates
Phenolics
Ureas
Polystyrenes

...and many special types and forms for different uses throughout modern cars. They offer wide selection of:

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Special Cements
Laminated Stock
Cast Resinoids
Fortifying Resins for automotive finishes

BAKELITE

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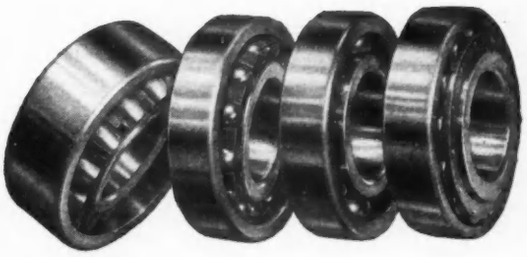
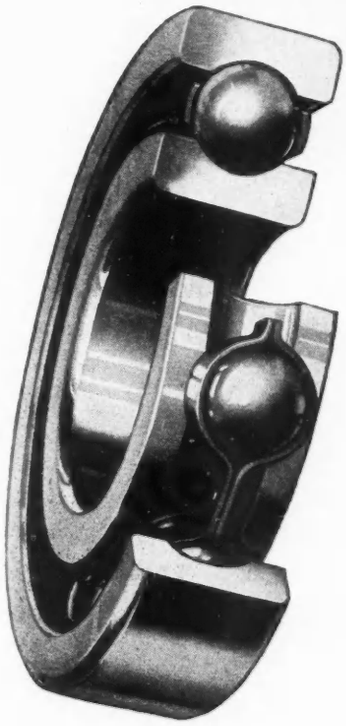
VISIT THE BAKELITE EXHIBIT, HALL OF INDUSTRIAL SCIENCE, NEW YORK WORLD'S FAIR 1939



AUTOCAR USES SKF TO PROTECT MOVING PARTS OF TRUCKS FROM WEAR

● *Model 2 TR, 142" wheelbase truck, first prize winner at recent Detroit Truck Show, built by The Autocar Company.*



THAT'S WHY AUTOCAR TRUCKS STAND UP ON LONG DISTANCE HAULS WITHOUT BEARING TROUBLE

● There are many places where WEAR can retard the smooth performance of rotating parts on a truck, but none of them is beyond the reach of SKF Bearings.

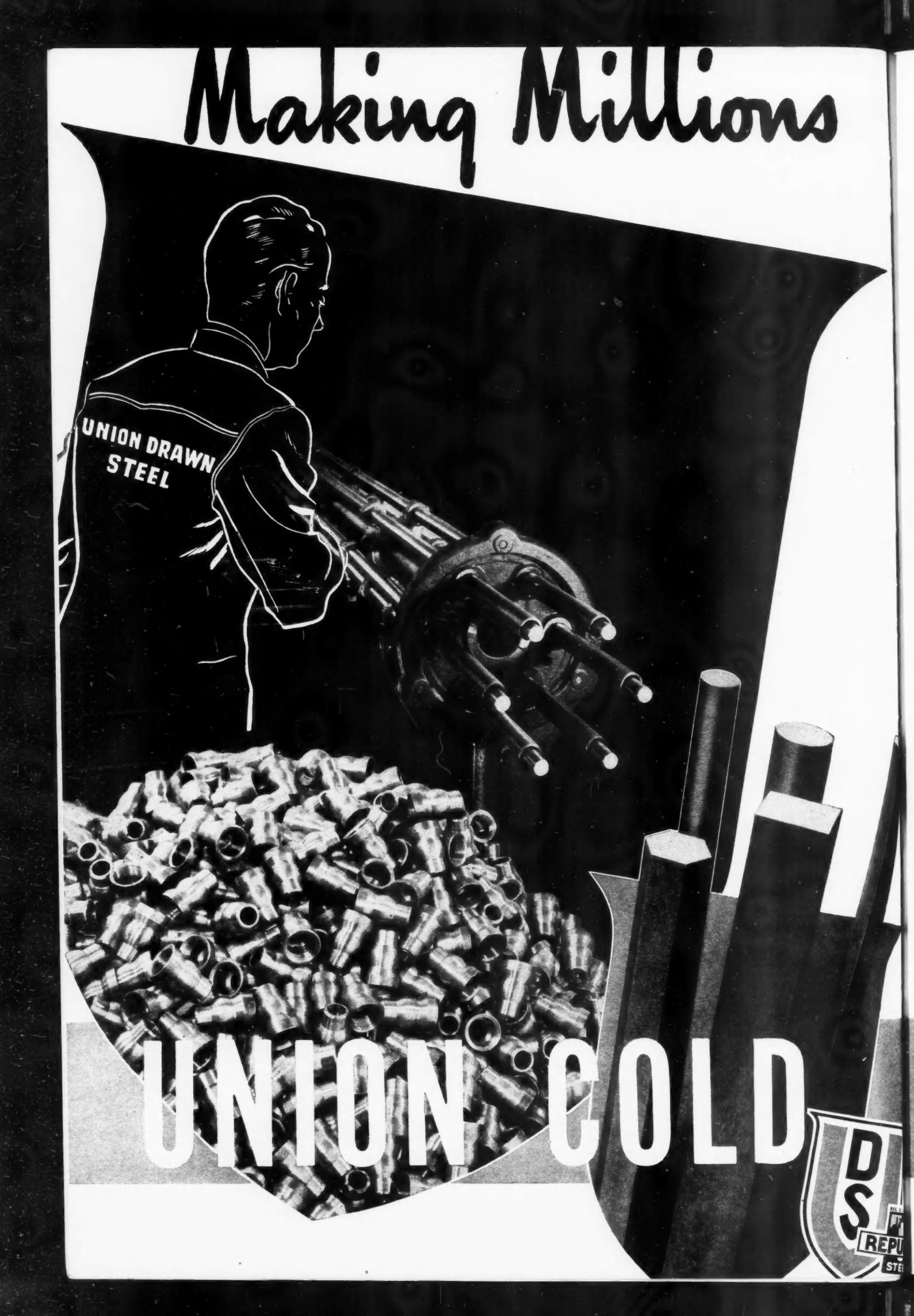
So Autocar, with the wisdom of long experience, selected SKF Bearings for vital turning parts of this Model 2 TR, 142" wheelbase truck.

The result is that this truck hauls heavy loads under rigorous conditions at low operating costs . . . that important rotating parts are protected against WEAR.

With Autocar trucks, as with SKF Bearings, a quality product has a background of sound engineering policies and service. Together, they insure low-cost transportation. Your nearest SKF representative stands ready to help *you* check WEAR with SKF Bearings. 4325

SKF
Ball and Roller Bearings

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.


Making Millions
UNION DRAWN
STEEL
UNION COLD

# of Useless Parts to EFFECT ECONOMIES in Your Production

• At the Union Drawn Division Massillon mill, modern automatic screw machines in charge of an experienced operator have been running continuously for years. Into their feed tubes have gone tons of bar steel. From their spindles have come millions of finished steel parts, destined only for the scrap heap.

They are "standard test parts" like that illustrated, incorporating every common "automatic" machining operation, but USELESS so far as application is concerned. Yet they serve a very practical purpose in helping manufacturers to make USEFUL parts of higher quality at lower cost.

Different steels—standard, special and experimental analyses—are cut under a variety of conditions. Their behavior is carefully observed and accurate records of speeds, feeds, surface finish, tool life and production time are kept and studied.

From this practical study of machinability have come many developments contributing new economies and other production benefits to the manufacture of steel parts.

1. It has formed the basis for research from which new free-cutting steels have been born and old analyses improved to afford greater machining efficiency.

2. It has pointed the way to alterations and improvements in steel processing methods which develop a higher degree of machinability in steels of all analyses.

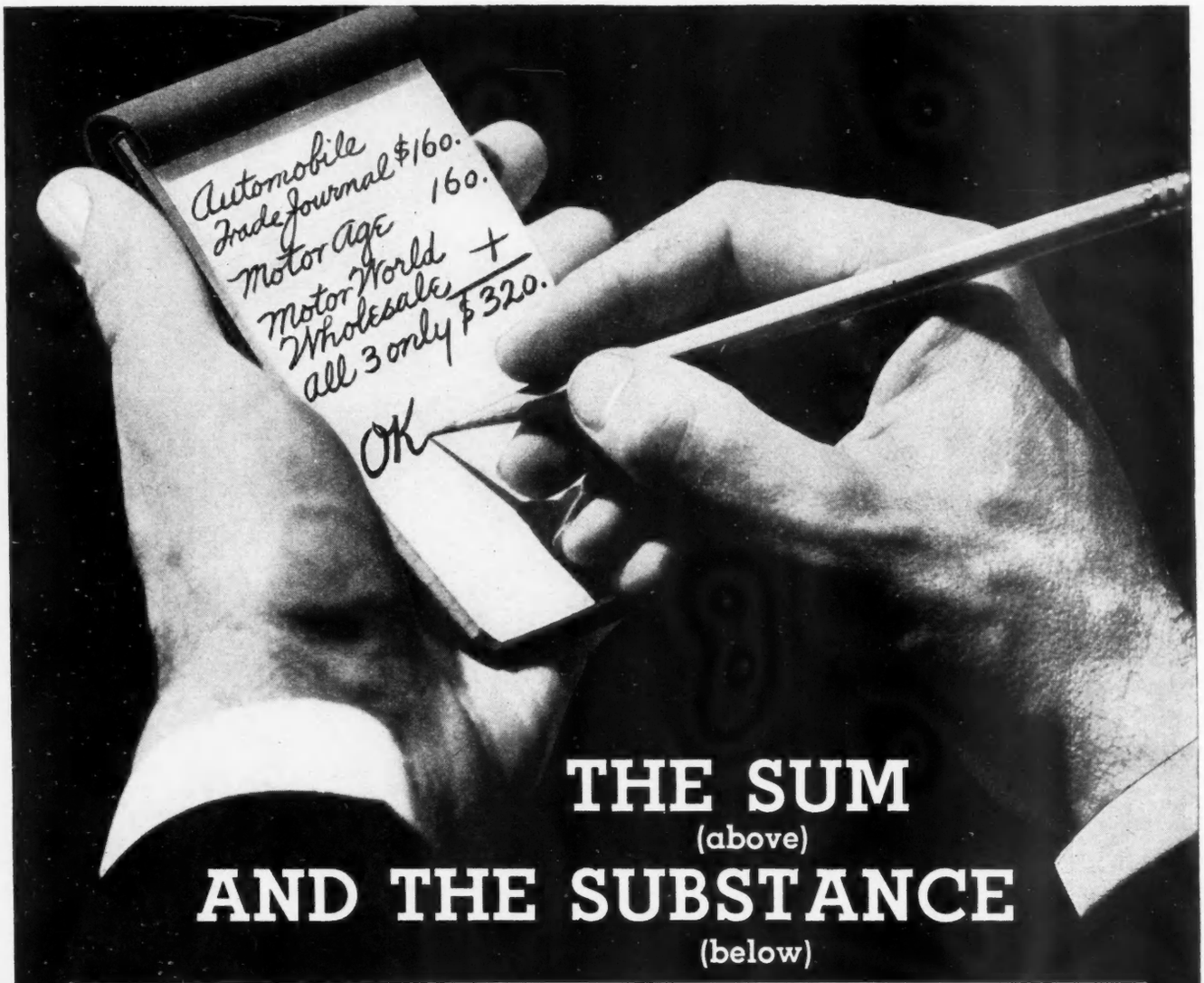
3. Finally, applied to field study of equipment, practice and products, it has enabled Union Drawn Field Service Men to offer constructive assistance to hundreds of parts manufacturers in lowering their costs and improving their output.

When a Union Drawn Field Service Man offers to work with you, remember that the knowledge he brings to your problems is backed by actual experience in the production of millions of steel parts. Union Drawn Steel Division of Republic Steel Corporation, Massillon, Ohio.

DRAWN STEELS

BESSEMER STEELS
Freecut (S. A. E. 1112) • Supercut (S. A. E. X-1112)

OPEN HEARTH AND ELECTRIC FURNACE STEELS
All Carbon and Alloy Analyses



THE SUM
(above)
AND THE SUBSTANCE
(below)

AUTOMOBILE TRADE JOURNAL	MOTOR AGE	MOTOR WORLD WHOLESALE
Car Dealers Exclusively	*Independent Service Stations Exclusively*	*Wholesalers Exclusively*
$160 per page on annual contract	**$160** per page on annual contract	**$85*** per page on annual contract

*but, instead of paying this $85 value you take it as your "dividend" —So All Three Cost You Only $320.—

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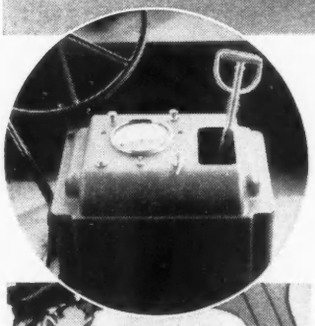
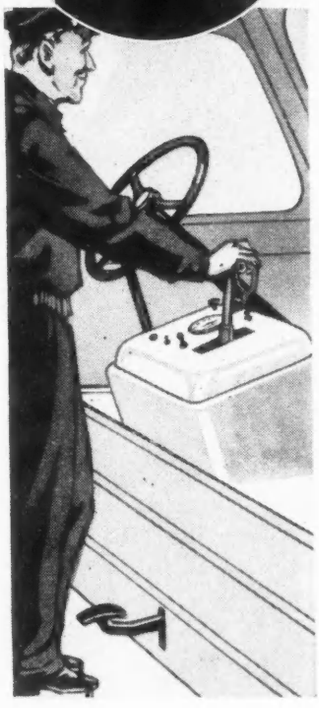
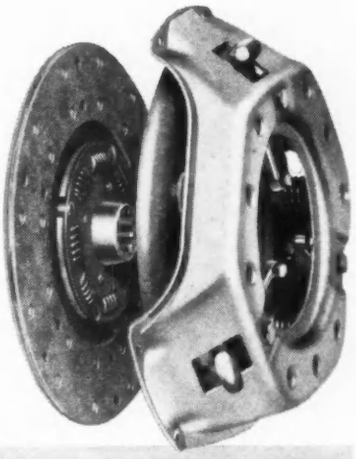




THE NEW WHITE HORSE USES A LONG C-F CLUTCH

Stop-and-go . . . stop-and-go . . . all day long, door-to-door delivery is probably the hardest service a clutch can experience, and the selection of a clutch becomes a matter of major importance to assure lasting dependability. Because it stands up in ANY service for which it is designed, the Long semi-centrifugal clutch was the natural selection of The White Motor Company for its new "White Horse" delivery unit. Ease of operation and endurance, the two main requirements of this service, are both found in Long clutches.



LONG

CLUTCHES AND RADIATORS

LONG MANUFACTURING DIVISION

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Should special body construction demand a type not obtainable from our standard line we will be glad to submit designs covering your requirements — no obligation.

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1306 HOLDEN AVENUE DETROIT, MICHIGAN

Men at work

in all corners of automotive industrial manufacturing plants influence the buying of materials, tools, machinery and equipment.

The men on whose practical judgment the choice of a specified purchase sometimes rests may very well be those upon whom the salesman for the supplying manufacturer does not—and cannot—call.

That is where Automotive Industries enters the selling picture for the supplier.

It helps to create and to maintain the good reputation for a product in quarters where that help will do the most good—among these unidentified influences in plant purchases of all kinds—in addition, of course, to the administrative and other executives.

AUTOMOTIVE INDUSTRIES

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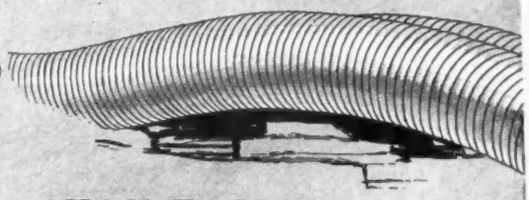
Versatility



YOU THINK OF

METAL

Let Versatile Flexible **METAL** Hose and Tubing help you to solve such problems as these.

- The problem of CONVEYING steam, liquids, gases . . . under pressure . . . at high or low temperatures . . . to moving machine parts, to portable equipment . . . for either temporary or permanent connections.

- The problem of ABSORBING VIBRATION where rigid connections would leak, fail or transmit undesirable noise . . . and yet to provide all the permanence and positive character of a continuous METAL connection.

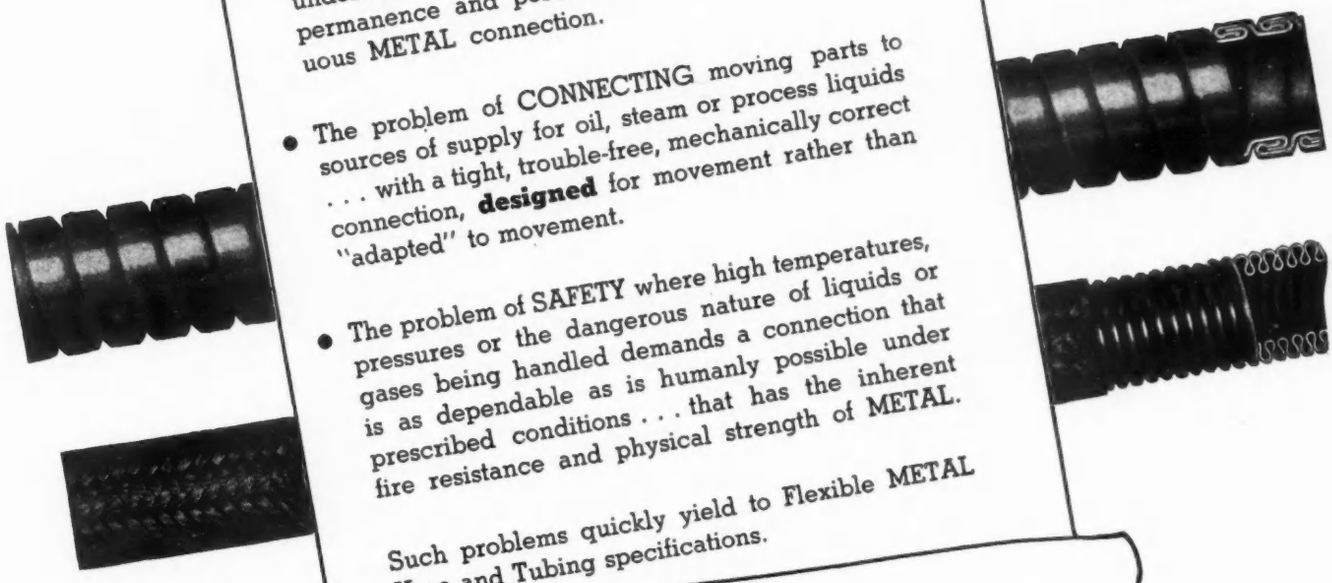
- The problem of CONNECTING moving parts to sources of supply for oil, steam or process liquids . . . with a tight, trouble-free, mechanically correct connection, **designed** for movement rather than "adapted" to movement.

- The problem of SAFETY where high temperatures, pressures or the dangerous nature of liquids or gases being handled demands a connection that is as dependable as is humanly possible under prescribed conditions . . . that has the inherent fire resistance and physical strength of METAL.

Such problems quickly yield to Flexible METAL Hose and Tubing specifications.

SEND FOR YOUR COPY
of the Institute "FACT BOOK"

It shows how and why such problems as those outlined here can be solved surely and at low cost by using the widely applicable Flexible METAL principle of hose and tube construction. It is free Send for your copy.



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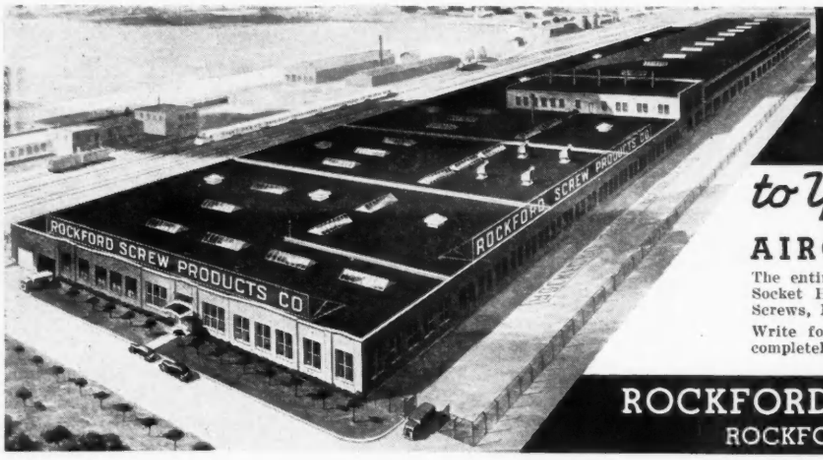

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Write for our aircraft or general catalog to determine just how completely we can serve your production needs.
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ROCKFORD ILLINOIS

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See Alphabetical List of Advertisers on page 82

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Forgings

Bethlehem Steel Co.
Carnegie-Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Park Drop Forge Co.
Wyman-Gordon Co.

Gages

Electric (Fuel Level)
King-Seeley Corp.

Gasoline, Auto
King-Seeley Corp.

Oil Pressure
King-Seeley Corp.

Water Temperature
King-Seeley Corp.

Gaskets

Felt
American Felt Co.

Gear Boxes

Cotta Transmission Corp.

Gear Material (Non-Metallic)

Bakelite Corp.
General Plastics, Inc.

Gears, Reduction

Cotta Transmission Corp.

Grinders, Portable Electric

Duro Metal Products Co.

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BUYERS' GUIDE—Continued

Grinding Machines

(*Internal*)
Heald Machine Co.

(*Surface*)
Heald Machine Co.

Hand Books, Ball Bearing Data

Bearings Co. of America

Hangers, Shafting

SKF Industries, Inc.

Heat Treating

Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D. Div. of Associated Spring Corp.

Hinges, Automobile Door (Concealed)

Ackerman-Blaesser-Fezzy, Inc.

Hoods

Metal Auto Parts Co., Inc.
Motors Metal Mfg. Co.

Hose, Flexible Metallic

Flexible Metal Hose & Tubing Institute

Hotels

Hotel Bellevue-Stratford
Hotel Drake
Hotel Syracuse

Instrument Panels

Metal Auto Parts Co., Inc.

Insulating Material

Bakelite Corp.
General Plastics, Inc.

Lamps, Industrial

General Electric Vapor Lamp Co.

Lathes

Automatic Chucking
Potter & Johnston Machine Co.

Turret
Potter & Johnston Machine Co.

Leaded Steels

Bliss & Laughlin, Inc. (Cold Finished)
Inland Steel Co.

Machine Work (Special Contract)

Govro-Nelson Co.

Machine, Straightening for Punch Presses

F. J. Littell Machine Co.

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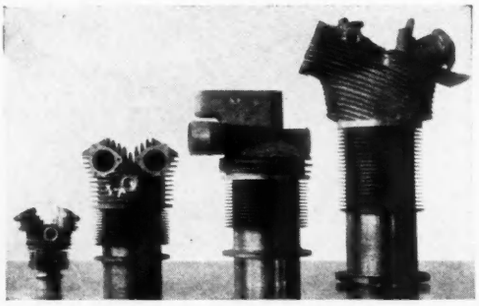

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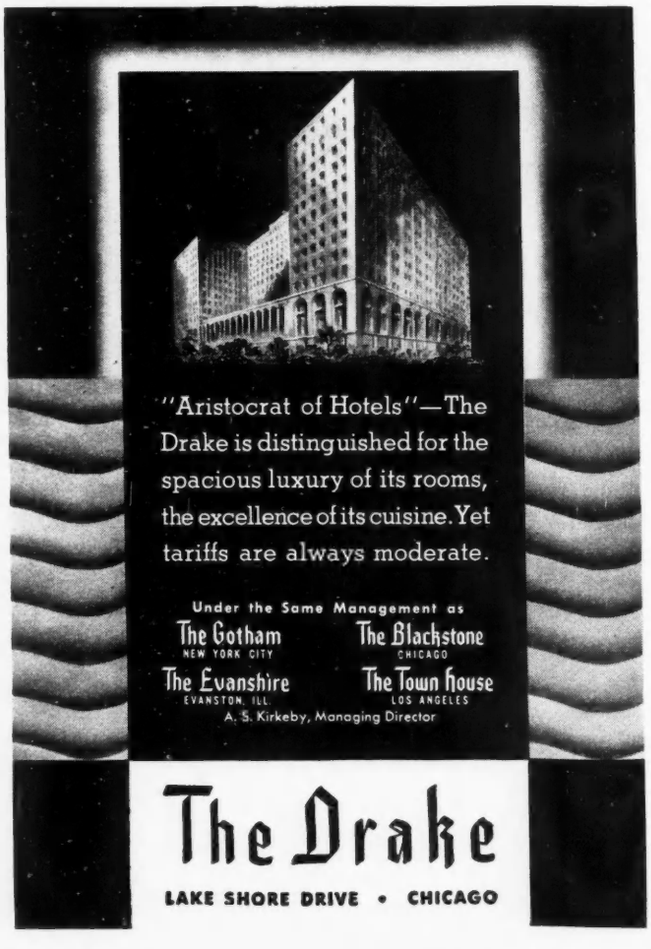
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General Plastics, Inc.

Milling Machines
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General Plastics, Inc.

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E. I. du Pont de Nemours & Co., Inc., Plastics Dept.

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Motors Metal Mfg. Co.

Oil Seals, Gyro-Stat
American Felt Co.

Oils
Break In
Acheson Colloids Corp.
Cutting
Cities Service Oil Co.
Lubricating
Acheson Colloids Corp.

Pads, Felt
American Felt Co.

Paints, Aluminum
Aluminum Co. of America

Parts
Aircraft Engine
Govro-Nelson Co.
Automotive Precision
Govro-Nelson Co.

Perforated Metal
Wickwire Spencer Steel Co.

Pistons
Aluminum Co. of America

Plastic Materials
Sheets, Rods & Tubes
E. I. du Pont de Nemours & Co., Inc., Plastics Dept.

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Waukesha Motor Co.

Power Unit Drives
Cotta Transmission Corp.

Punch Press Feeds
F. J. Littell Machine Co.

Radiators
Long Mfg. Division of Borg-Warner Corp.

Radiator Shields
Metal Auto Parts Co., Inc.
Motors Metal Mfg. Co.

Radio, Remote Control
S. S. White Dental Mfg. Co.

Reels, Automatic Centering (Coil Stock)
F. J. Littell Machine Co.

Refrigerator Stampings
Metal Auto Parts Co., Inc.
Motors Metal Mfg. Co.

Rivets
Bethlehem Steel Co.
Progressive Mfg. Co.

Running Board Shields
Metal Auto Parts Co., Inc.
Motors Metal Mfg. Co.

Running Boards
Metal Auto Parts Co., Inc. (Metal)
Motors Metal Mfg. Co.

Screens, Woven Wire
Wickwire Spencer Steel Co.

Screw Machine Products
Barnes Co., Wallace, Div. of Associated Spring Corp.
Progressive Mfg. Co.

Screw Machines
Potter & Johnston Machine Co.

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Screw Stock, Cold Drawn
Bliss & Laughlin, Inc.

Screws

Cap
Rockford Screw Products Co.

Machine
American Screw Co.
Continental Screw Co.
Corbin Screw Corp.
Lamson & Sessions Co.
National Acme Co.
National Screw & Mfg. Co.
Parker-Kalon Corp.
Pheoll Mfg. Co.
Progressive Mfg. Co.
Rockford Screw Products Co.
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.

Recessed Head
American Screw Co.
Continental Screw Co.
Corbin Screw Corp.
Lamson & Sessions Co.
National Screw & Mfg. Co.
Parker-Kalon Corp.
Pheoll Mfg. Co.
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.

Set
Rockford Screw Products Co.

Sheet Metal
American Screw Co.
Continental Screw Co.
Corbin Screw Corp.
Lamson & Sessions Co.
National Screw & Mfg. Co.
Parker-Kalon Corp.
Pheoll Mfg. Co.
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.

Wood
American Screw Co.
Continental Screw Corp.
Corbin Screw Corp.
Lamson & Sessions Co.
National Screw & Mfg. Co.
Parker-Kalon Corp.
Pheoll Mfg. Co.
Rockford Screw Products Co.
Russell, Burdsall & Ward Bolt & Nut Co.
Scovill Mfg. Co.

Shafting
Bliss & Laughlin, Inc.
Jones & Laughlin Steel Corp. (Turned & Polished, Turned & Ground, Cold Drawn)
Union Drawn Steel Co.

Shafting, Steel, Cold Drawn
Bliss & Laughlin, Inc.

Shafts, Axle, Propeller and Transmission
Mechanics Universal Joint (Division Borg-Warner Corp.)

Shafts & Casings, Flexible (Radio)
S. S. White Mfg. Co.

Springs

Extensions, Compression, Torsion or Flat
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson-Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Jones & Laughlin Steel Corp.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Wickwire Spencer Steel Co.

Stampings or Drawings, Metal
Barnes Co., Wallace, Div. of Associated Spring Corp.
Barnes - Gibson - Raymond, Div. of Associated Spring Corp.
Cook Plant of Barnes-Gibson - Raymond, Div. of Associated Spring Corp.
Gibson Co., Wm. D., Div. of Associated Spring Corp.
Motors Metal Mfg. Co.
Raymond Mfg. Co., Div. of Associated Spring Corp.
Worcester Stamped Metal

Stands, Reel (Coil Stock)
F. J. Littell Machine Co.

Steel

Alloys
Bethlehem Steel Co.
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp., Subsidiary
Foote Bros. Gear & Machine Corp.
Republic Steel Corp.
Union Drawn Steel Co.

Bars
Bethlehem Steel Co.
Carnegie - Illinois Steel Corp., U. S. Steel Corp., Subsidiary

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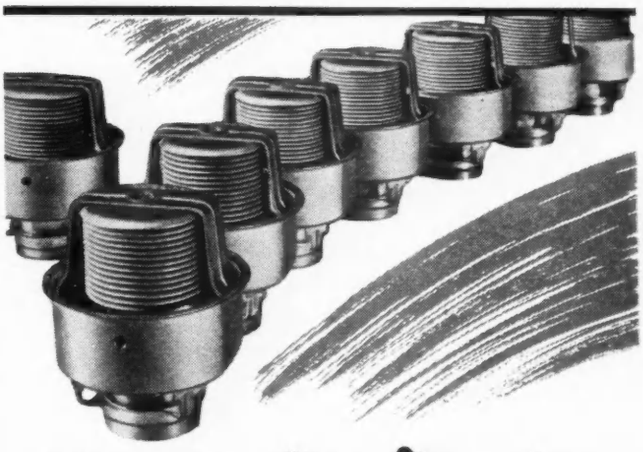

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Republic Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Billets
Bethlehem Steel Co.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Carbon
Bethlehem Steel Co.
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Cold Drawn
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Bliss & Laughlin, Inc.
Jones & Laughlin Steel Corp.
Republic Steel Corp.
Union Drawn Steel Co.

Cold Draw Flats
Bliss & Laughlin, Inc.

Electric Furnace
Bethlehem Steel Co.
Bliss & Laughlin, Inc.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Plates
Inland Steel Co.

Rails
Inland Steel Co.

Shapes
Bethlehem Steel Co.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Jones & Laughlin Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Sheets
Bethlehem Steel Co.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
Inland Steel Co.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary

Spring
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Barnes Co., Wallace, Div. of Associated Spring Corp.
Union Drawn Steel Co.

Stainless
American Steel & Wire Co., U. S. Steel Corp. Subsidiary
Bethlehem Steel Co.
Carnegie - Illinois Steel Corp., U. S. Steel Corp. Subsidiary
Columbia Steel Co., U. S. Steel Corp. Subsidiary
National Tube Co., U. S. Steel Corp. Subsidiary
Republic Steel Corp.
Tennessee Coal, Iron & Railroad Co., U. S. Steel Corp. Subsidiary
Union Drawn Steel Co.

Strip
Bethlehem Steel Co.
Inland Steel Co.
Republic Steel Co.

Structural
Inland Steel Co.

Vanadium
Republic Steel Co.

Transmissions, Heavy Duty
Cotta Transmission Corp.

Tubing

Flexible Metallic
Flexible Metal Hose & Tubing Institute

Steel
Timken Roller Bearing Co.

Turret Machines, Automatic
Potter & Johnston Machine Co.

Universal Joints
Mechanics Universal Joint Co., Div. Borg - Warner Corp.

Varnishes
Bakelite Corp.
General Plastics, Inc.

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BUYERS' GUIDE—Continued

Washers
Felt
American Felt Co.
Lock
Thompson-Bremer Co.

Welders, Electric
Westinghouse Electric & Mfg. Co.

Welding Material
P. R. Mallory Co. (Dies for Arc & Resistance Welding)

Wicks
Felt
American Felt Co.

Window Regulators
Ackerman-Blaesser-Fezzy, Inc.

Wire
Cloth
Wickwire Spencer Steel Co.
Flat, Round, Square or Special Shapes
Barnes Co., Wallace, Div. of Associated Spring Corp.
Bethlehem Steel Co.
Wickwire Spencer Steel Co.
Piano & Music
Wickwire Spencer Steel Co.
Spring
Barnes Co., Wallace, Div. of Associated Spring Corp.
Republic Steel Co.

Wire Rope
Wickwire Spencer Steel Co.

Zinc, Sheets, Slabs, Sticks, Strips, etc.
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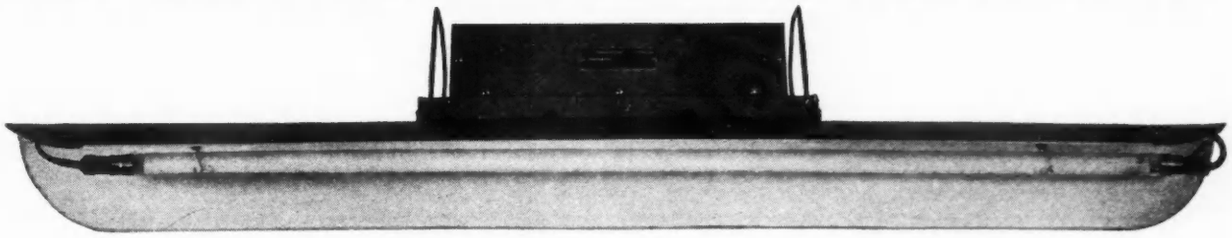

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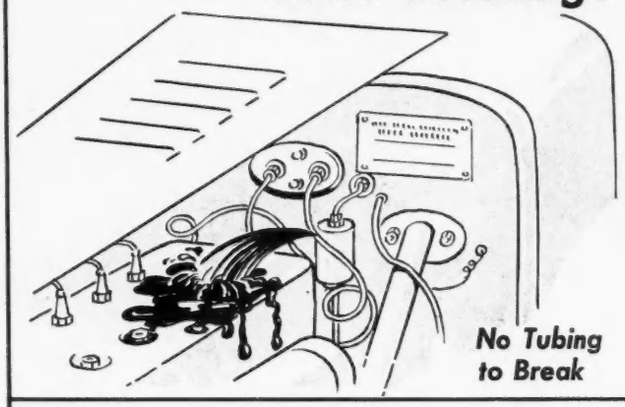
No Tubes to Telegraph Engine Noise to Dash

are More Easily Installed and Assembled

Wires Snap Easily Into a Junction Block

avoid Danger of Tube Breakage



No Tubing to Break

are Dependable

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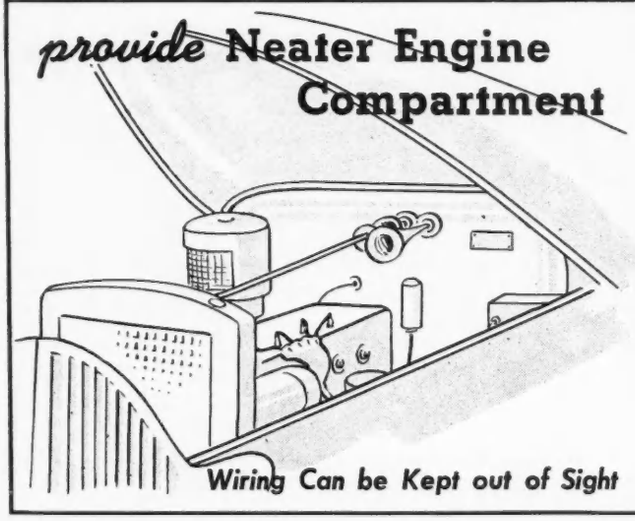
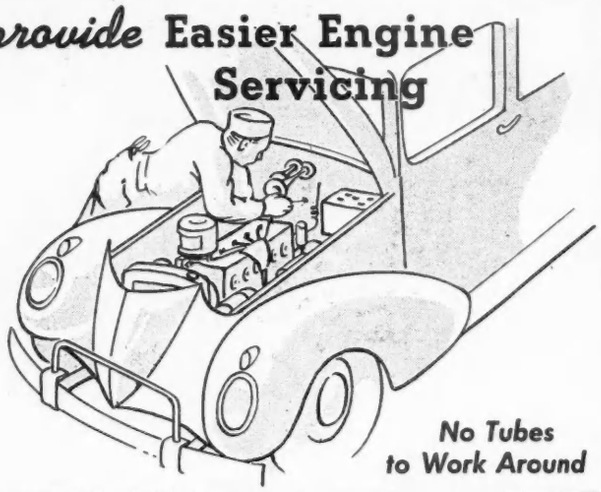
provide Neater Engine Compartment



Wiring Can be Kept out of Sight

provide Easier Engine Servicing



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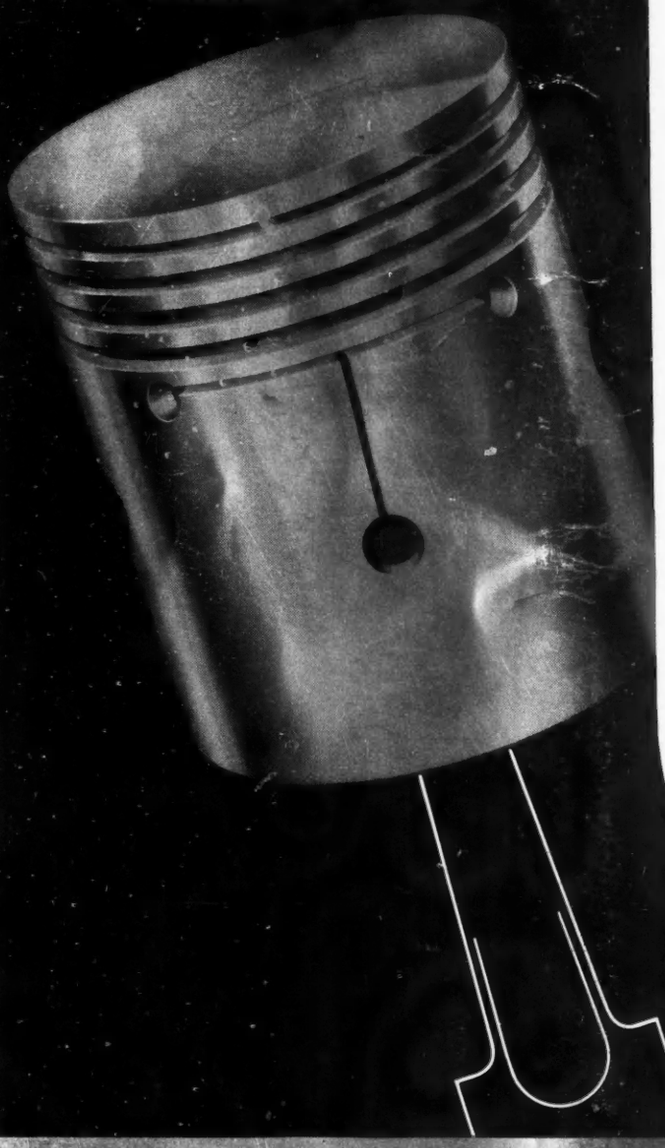

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LO-EX

REG. U. S. PAT. OFF.

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